Volkswagen Group of America, Inc.
v.
Carucel Investments, LP

IPR2019-01101 - IPR2019-01102 - IPR2019-01103 - IPR2019-01105

U.S. Patent Nos. 7,221,904 - 7,848,701 - 7,979,023 - 8,718,543

VOLKSWAGEN

GROUP OF AMERICA

Petitioner's Demonstratives

Volkswagen EX1049
VW GoA v. Carucel
IPR2019-01102

Petitioner's Demonstrative Exhibit
Not Evidence

Agenda

I. ’023 Patent - IPR2019-01103

II. ’701 Patent - IPR2019-01102

III. ’543 Patent - IPR2019-01105

IV. ’904 Patent - IPR2019-01101 (and IPR2019-01573)

Introduction to the Challenged Patents

Alleged problem solved by Challenged Patents

> The '023 patent purports to solve the alleged handoff problem using a "moving base station." *See* Ex. 1001, 5:10-18. The moving base station performs the handoff function, and "[a]dvantageously, because [] movement of the base station [is] in the same direction as the traveling mobile unit, the number of handoffs is greatly reduced." Ex. 1001, 5:17-19. That is, the mobile unit is able to

'023 Pet., Paper 2, p. 11.

Introduction to the Challenged Patents

System of the Challenged Patents

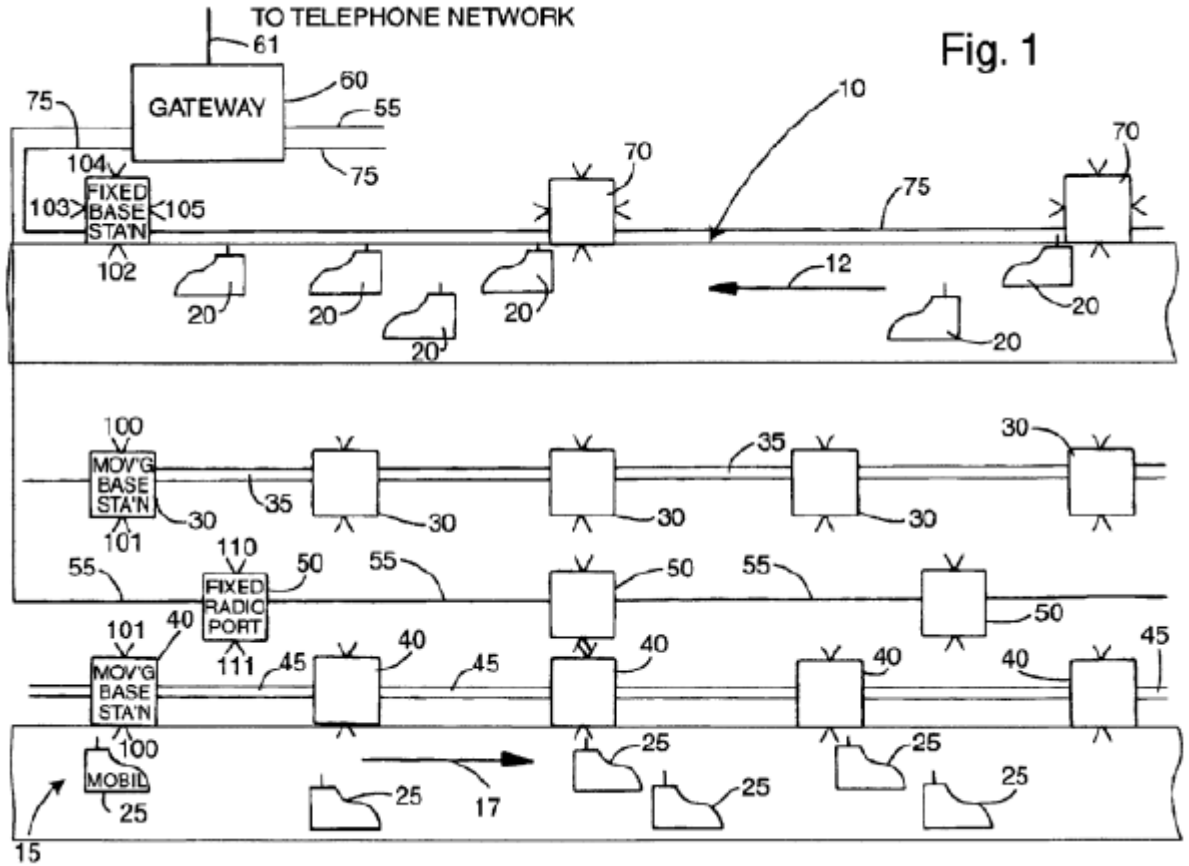


Fig. 1

'023 Patent, EX1001, FIG.1; '023 Pet., Paper 2, p. 12.

Instituted Grounds

IPR2019-01103 (’023 Patent)		
	Claim(s)	References
Ground 1	11, 16-21	Ito (EX1005) and Gardner (EX1006)
Ground 2	22	Ito, Gardner, and Gilhousen390 (EX1007)
Ground 3	23	Ito, Gardner, and Fenwick (EX1008)
Ground 4	11, 16-22	Gilhousen865 (EX1009) and Gilhousen390
Ground 5	23	Gilhousen865, Gilhousen390 and Fenwick

’023 Pet., Paper 2, p. 7; ’023 DI., Paper 7, pp. 7, 30.

Petitioner’s Demonstrative Exhibit
Not Evidence

’023 Patent – Independent Claim 11

IPR2019-01103 (’023 Patent) – Claim 11
11. An apparatus configured to move relative to Earth, the apparatus comprising:
a plurality of spatially separated antennas; and
a receiver configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas; and
a transmitter configured to transmit radio frequency signals to a mobile device corresponding to the received fixed port signals.

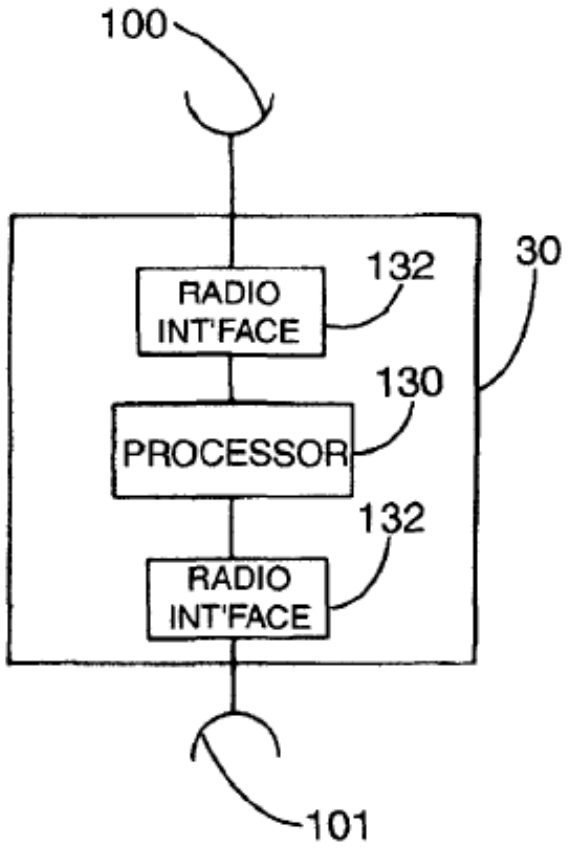


Fig. 4

’023 Pet., Paper 2, p. 13; ’023 Patent, EX1001, FIG.4.

Undisputed Issues

IPR2019-01103 (’023 Patent)
✓ Ito Discloses an Apparatus Configured to Move Relative to Earth
✓ Gardner Discloses a Plurality of Spatially Separated Antennas
✓ Ito + Gardner Discloses a Receiver Configured to Receive Fixed Port Signals from a Fixed Port Through the Plurality of Spatially Separated Antennas
✓ Ito Discloses a Transmitter Configured to Transmit Radio Frequency Signals Corresponding to the Received Fixed Port Signals
✓ Gilhousen390 Discloses a Plurality of Spatially Separated Antennas
✓ Gilhousen865 + Gilhousen390 Discloses a Receiver Configured to Receive Fixed Port Signals from a Fixed Port Through the Plurality of Spatially Separated Antennas
✓ Gilhousen865 Discloses a Transmitter Configured to Transmit Radio Frequency Signals Corresponding to the Received Fixed Port Signals

IPR2019-01103 (’023 Patent) – Claim 11
11. An apparatus configured to move relative to Earth, the apparatus comprising:
a plurality of spatially separated antennas; and
a receiver configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas; and
a transmitter configured to transmit radio frequency signals to a mobile device corresponding to the received fixed port signals.

’023 POR, Paper 12; ’023 Patent, EX1001, 12:8-16.

Ito's Mobile Base Device (MSS) Discloses an Apparatus Configured to Move Relative to Earth

✓ Ito Discloses an Apparatus Configured to Move Relative to Earth

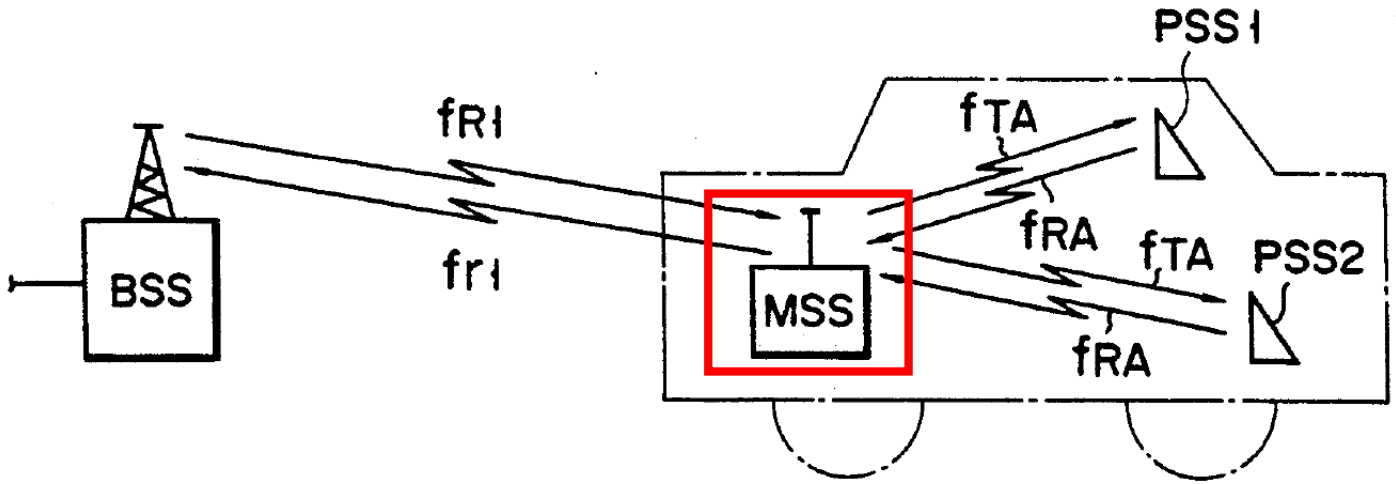


FIG. 6

Ito, EX1005, FIG. 6 (annotated); '023 Pet., Paper 2, pp. 18 and 29.

Ito's MSS Includes a Receiver Configured to Receive a Plurality of Signals

Ito Discloses a Receiver Configured to Receive Fixed Port Signals from a Fixed Port

Ito's MSS includes a "first transmitter-receiver unit 50"

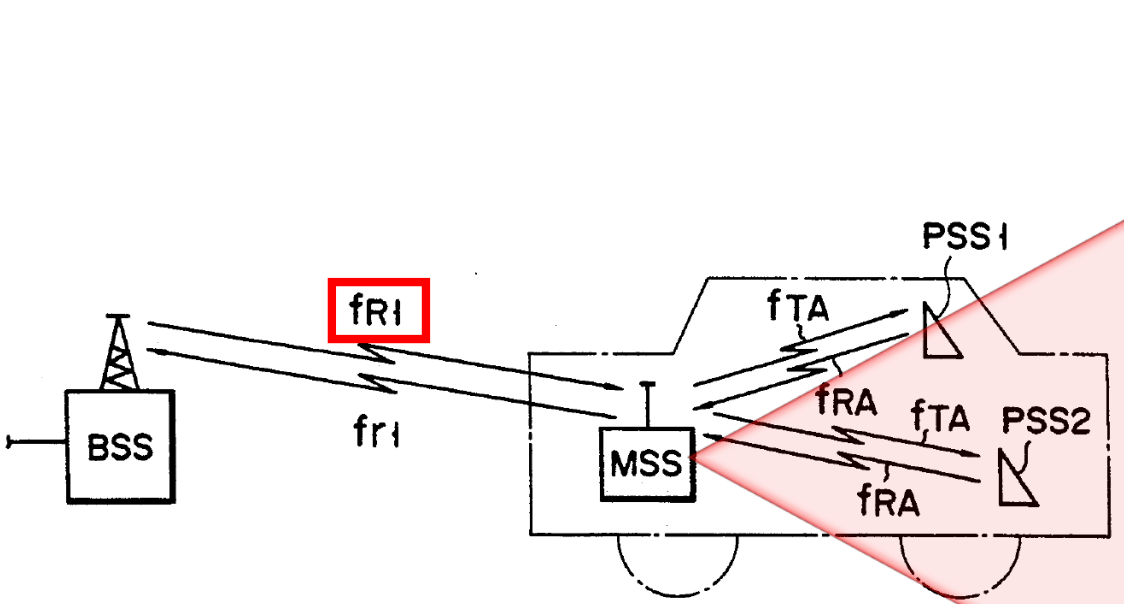


FIG. 6

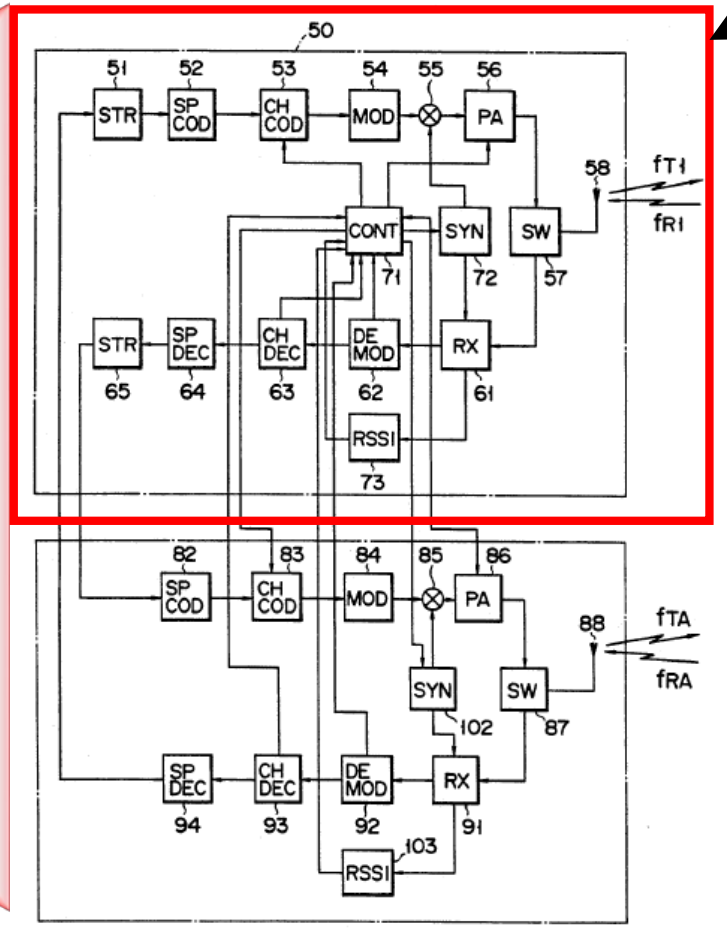


FIG. 3

Ito, EX1005, FIGs. 3, 6 (annotated); '023 Pet., Paper 2, pp. 31-34.

Ito's MSS Includes a Receiver Configured to Receive a Plurality of Signals

Ito's MSS Receives a Plurality of Cellular Signals From a Plurality of BSSs

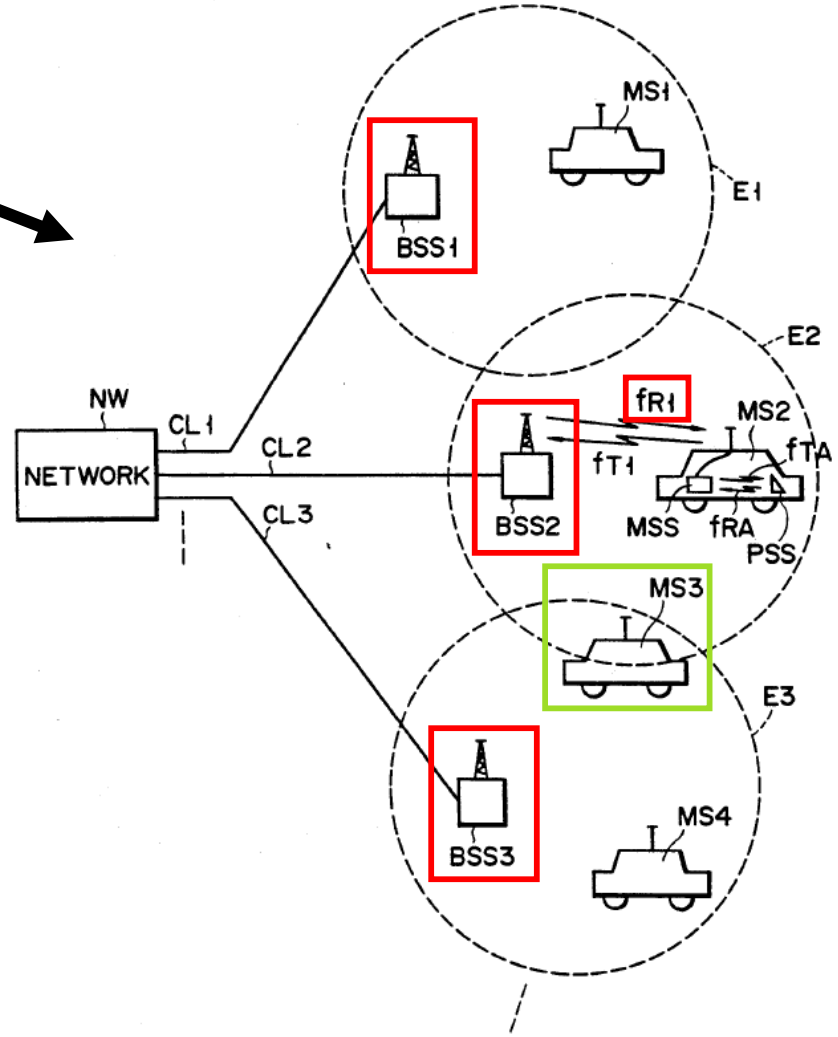


FIG. 1

✓ Ito Discloses a Receiver Configured to Receive Fixed Port Signals from a Fixed Port

Ito, EX1005, FIGs. 3, 1 (annotated); '023 Pet., Paper 2, p. 32.

Gardner Discloses a Plurality of Spatially Separated Antennas

Gardner Discloses a Plurality of Spatially Separated Antennas

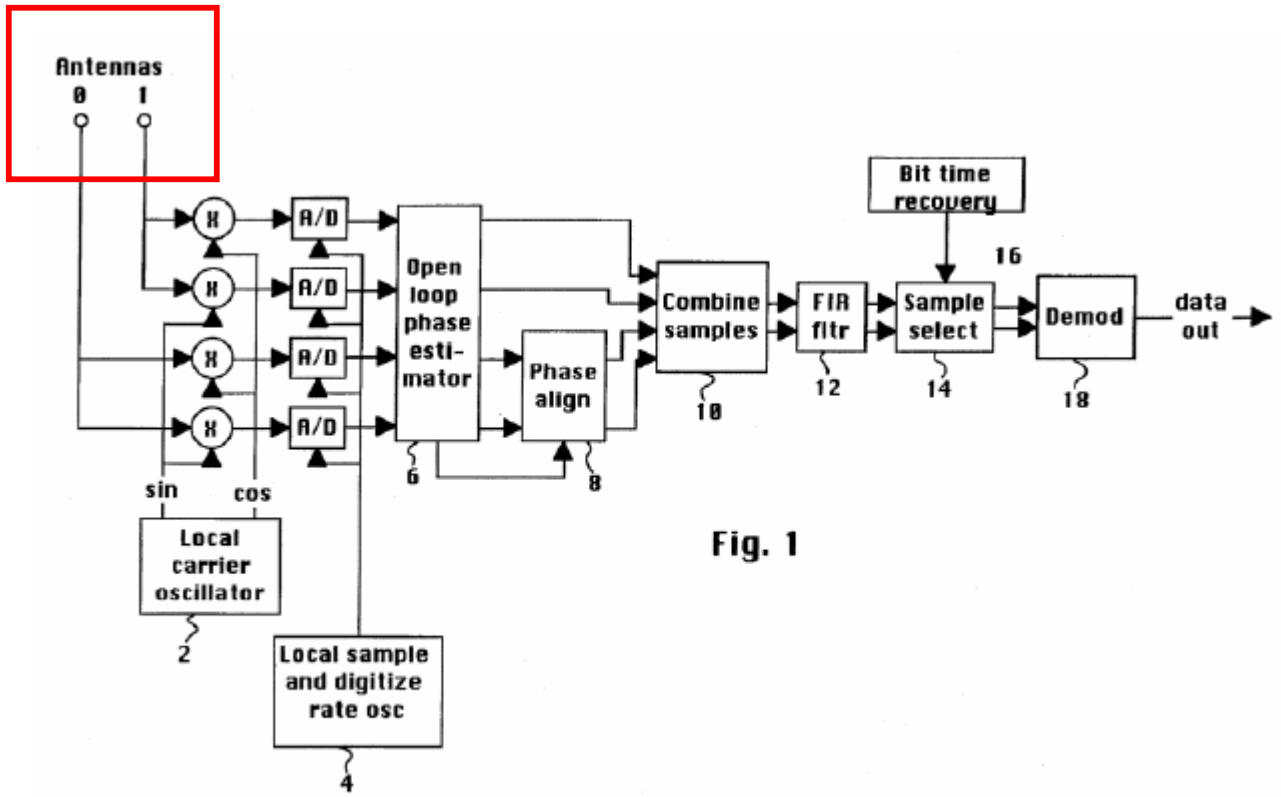


Fig. 1

Gardner, EX1006, FIG. 1 (annotated); ’023 Pet., Paper 2, p. 34.

Ito + Gardner Discloses Communications Using a Plurality of Spatially Separated Antennas

Exemplary Combination of Ito with Gardner's Spatially Separated Antennas

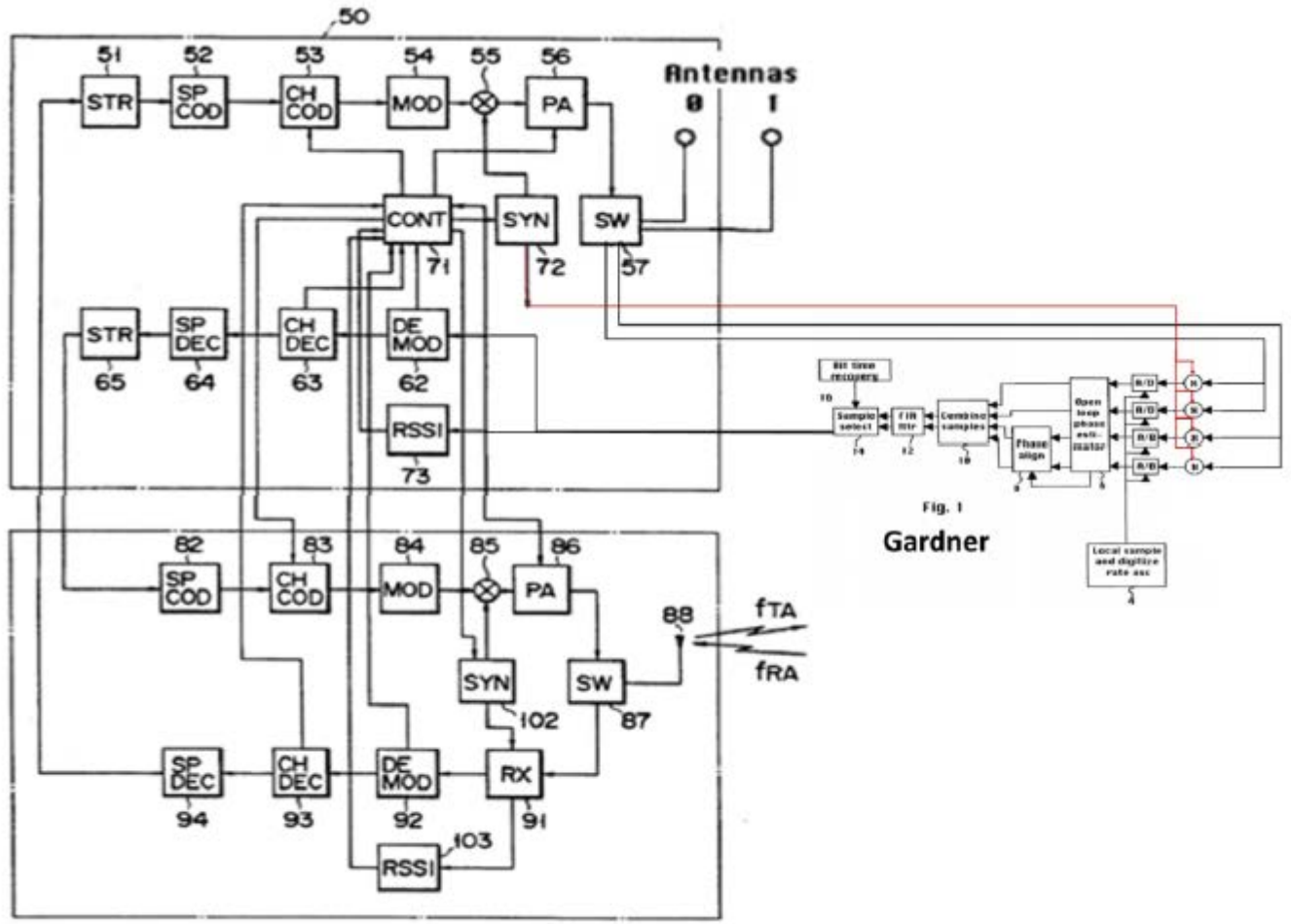


FIG. 3 Ito

Fig. 1

Gardner

Ito + Gardner Discloses a Receiver Configured to Receive Fixed Port Signals from a Fixed Port Through the Plurality of Spatially Separated Antennas

Denning Decl., EX1003, p. 57; '023 Pet., Paper 2, pp. 29-31.

Ito's MSS Includes a Transmitter Configured to Transmit Radio Signals to a Portable Device

Ito's MSS includes a "second transmitter-receiver unit 80"

Ito Discloses a Transmitter Configured to Transmit Radio Frequency Signals Corresponding to the Received Fixed Port Signals

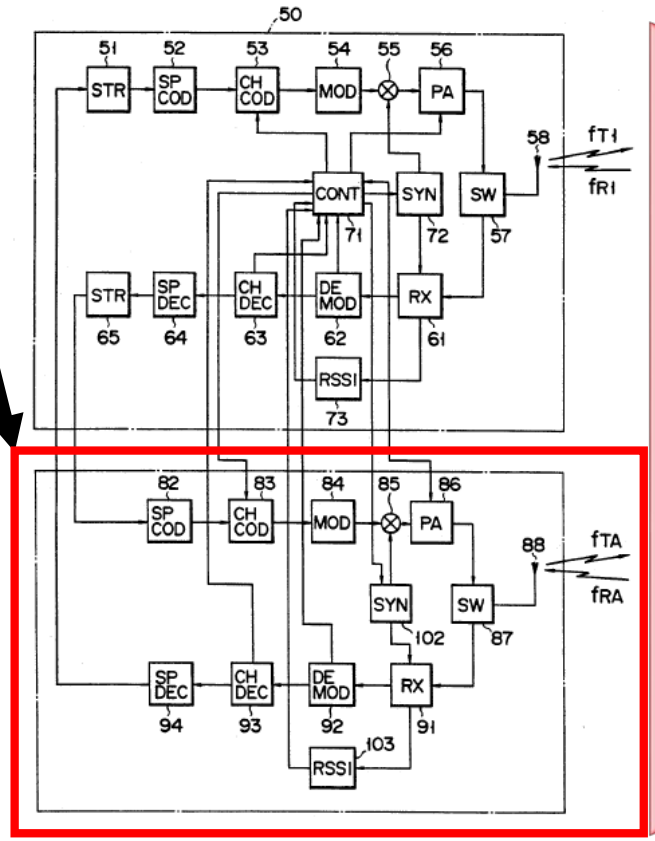


FIG. 3

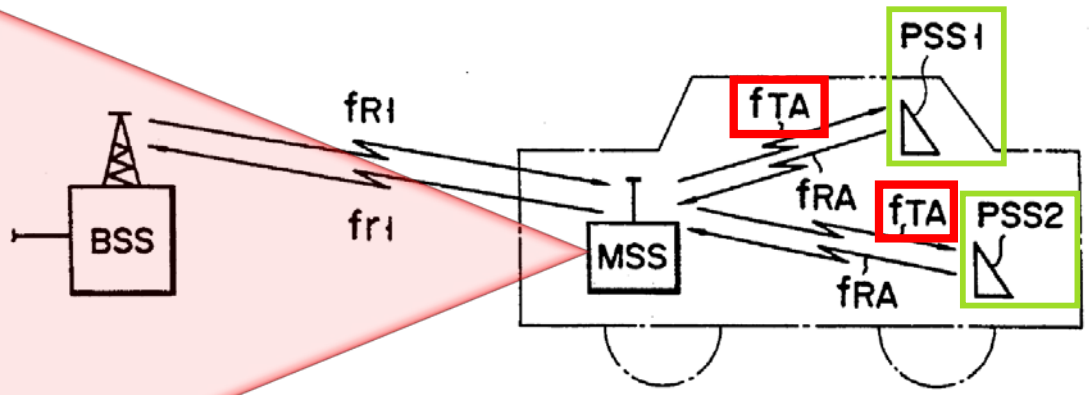


FIG. 6

Ito, EX1005, FIGs. 3, 6 (annotated); '023 Pet., Paper 2, pp. 35-36.

Gilhousen390 Discloses a Plurality of Spatially Separated Antennas

Gilhousen390 Discloses a Plurality of Spatially Separated Antennas

35 FIG. 3 illustrates in block diagram form an exemplary embodiment of the cell-site equipment. At the cell-site, two receiver systems are utilized with each having a separate antenna and analog receiver for space diversity reception. In each of the receiver systems the signals are

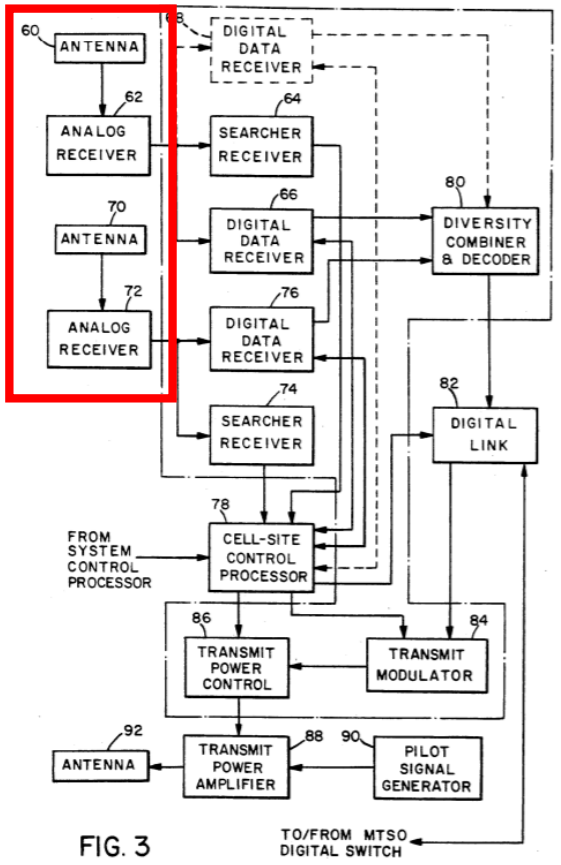


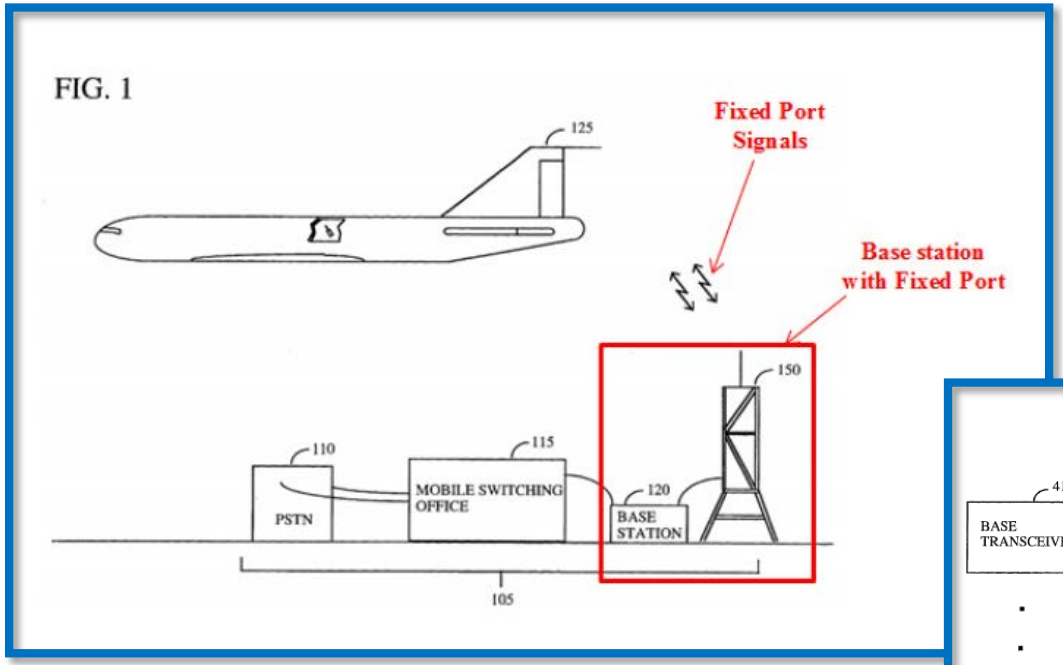
FIG. 3

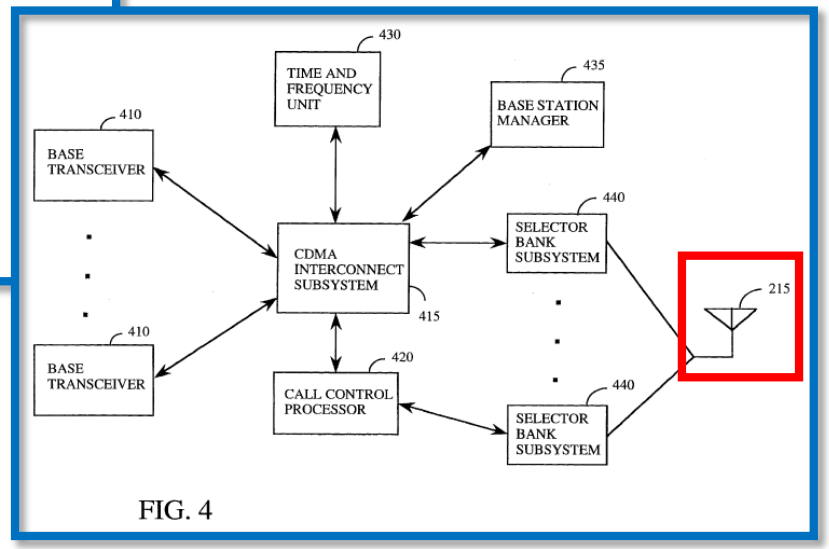
Gilhousen390, EX1007, 14:36-39, FIG. 3; '023 Pet., Paper 2, p. 57.

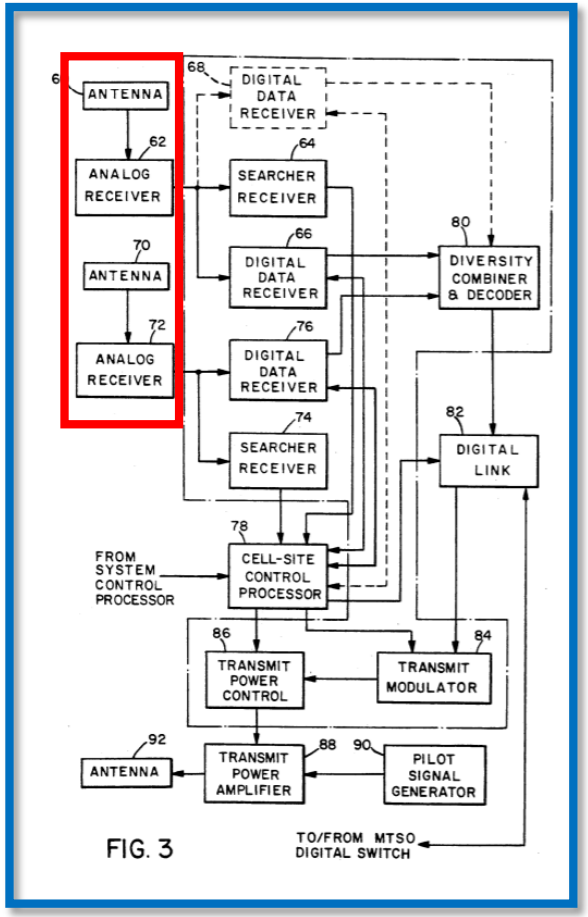
Petitioner's Demonstrative Exhibit
Not Evidence

Gilhousen865 + Gilhousen390 Discloses a Receiver Configured to Receive Fixed Port Signals from a Fixed Port Through the Plurality of Spatially Separated Antennas

Gilhousen865 + Gilhousen390 Discloses a Receiver Configured to Receive Fixed Port Signals from a Fixed Port Through the Plurality of Spatially Separated Antennas







Gilhousen865, FIGs. 1, 4 (annotated); Gilhousen390, FIG. 3 (annotated); '023 Pet., Paper 2, p. 59.

Petitioner's Demonstrative Exhibit
Not Evidence

Gilhousen865 Discloses a Transmitter Configured to Transmit Radio Frequency Signals Corresponding to the Received Fixed Port Signals

Gilhousen865 Discloses a Transmitter Configured to Transmit Radio Frequency Signals Corresponding to the Received Fixed Port Signals

described in Tiedemann. The signals from the ground base stations are received by the external antenna of the airborne subsystem and repeated to the radiotelephones. This enables

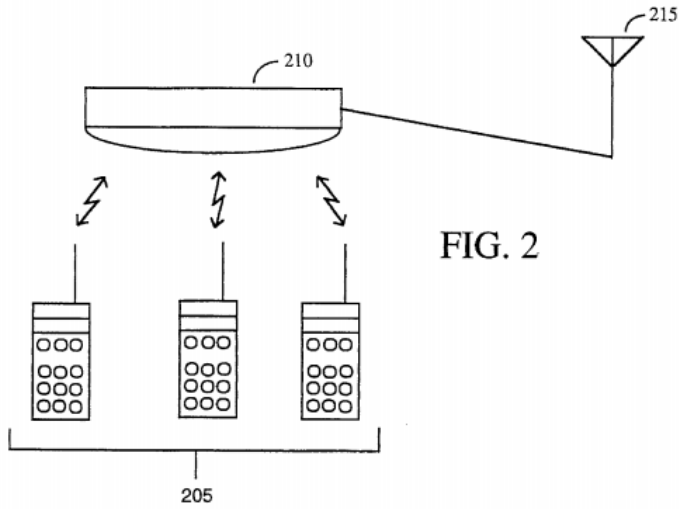


FIG. 2

Gilhousen865, 3:55-57, FIG. 2; '023 Pet., Paper 2, p. 60.

Disputed Issues

I. Claim Construction
   A. Mobile Device
   B. Automotive Vehicle
II. Ito + Gardner
   A. Ito discloses a “mobile device”
   B. Gardner discloses selecting a “best signal”
III. Gilhousen865 + Gilhousen390
   A. Gilhousen865 discloses “an apparatus configured to move relative to Earth”
   B. Gilhousen865 discloses a “mobile device”
   C. Gilhousen865 discloses an “automotive vehicle”
IV. Motivation to Combine
   A. Ito + Gardner + Gilhousen390
   B. Gilhousen865 + Gilhousen390

’023 POR, Paper 12.

Disputed Issues – Claim Construction "Mobile Device"

Proposed Construction of "Mobile Device"	
VWGoA	Patent Owner
"Plain and Ordinary Meaning"	"a device that must register with and be able to directly communicate with the cellular network."
Alternatively: "a movable device capable of receiving and transmitting radio signals"	

'023 Petitioner's Reply, Paper 19, pp. 4-8;
'023 POR, Paper 12, pp. 13-16.

Disputed Issues – Claim Construction "Mobile Device"

VWGoA's Argument – No construction needed

needed for two reasons. First, not construing the term "*mobile device*" is consistent with the position that both PO and the district court for the Southern District of California agreed to in *Carucel Investments L.P. v. Novatel Wireless, Inc. et al.*, Case No. 3:16-cv-0118-H-KSC (S.D. Cal.), Markman Order, 20 (Sept. 19, 2016).

Second, the challenged claims are not directed to the "*mobile device*," which is merely ancillary to what is actually being claimed—the "apparatus" (the moving base station). EX1039, 163:18-164:7. A long held principle of claim construction states that "[i]nclusion of the material or article worked upon by a structure being claimed does not impart patentability to the claims." *In re Otto*, 312 F.2d 937, 940 (C.C.P.A. 1963). The "*mobile device*" is not a positively recited element of the apparatus, but rather an external device upon which the claimed apparatus acts.

'023 Petitioner's Reply, Paper 19, pp. 5-6.

Disputed Issues – Claim Construction "Mobile Device"

VWGoA's Alternative Construction –
"a movable device capable of receiving and transmitting radio signals"

> capable of receiving and transmitting radio frequency signals." This construction is not only consistent with the specification and the prosecution history, but is also consistent with the plain language of the claims, which merely require that a moving base station transmitter can "*transmit radio frequency signals to a mobile device*" (claim 11) and that a moving base station receiver can "*receive mobile device signals from a mobile device*" (claim 1).

'023 Petitioner's Reply, Paper 19, p. 8.

Petitioner's Demonstrative Exhibit
Not Evidence

Disputed Issues – Claim Construction
"Mobile Device"

Carucel's Argument

from the cellular network. *See id*. at ¶¶ 60-62. As set forth in the '023 Patent, a mobile device:

> "**must register** in the manner described earlier, **by transmitting its unique address in the new service area**. The address will be received by the closest moving base station 30 and transmitted via a fixed radio port and the gateway switch 60 to the telephone network. **This registration procedure is required so that an incoming call for the mobile unit can be appropriately directed**." (Ex. 1001, Col. 9, ln. 62 – Col. 10, ln. 2 (emphasis added).

A mobile device is more than just a cordless phone handset. The '023 Patent specification teaches that a mobile device must be capable of directly communicating with either a fixed cellular base station or a moving base station. *See, e.g.*, Ex. 1001, 4:48-51 ("In the arrangement of FIG. 1, fixed base stations 70 would accommodate communications with mobile units traveling at a speed of less than 30 miles per hour including pedestrian traffic and stationary units."); Lanning

'023 POR, Paper 12, pp. 13-14.

Disputed Issues – Claim Construction "Mobile Device"

VWGoA's Reply

'023 Patent Claims

"*apparatus*." Each claim separately recites ***the apparatus*** as receiving and transmitting signals from/to a base station/fixed port. In this manner, the claims expressly require the "*apparatus*"—and not the "*mobile device*"—to communicate directly with the cellular network. Thus, the claims themselves directly contradict Carucel's construction.

Prosecution History

"*mobile device*." During prosecution of related Appl. No. 09/401,584 (now U.S. Patent No. 7,221,904), PO argued for a broader meaning: that "mobile units" include "telephones, radio modems, or other types of radios." EX1023, '904 Pros.

'023 Patent Specification

these disclosures merely describe specific embodiments. Additionally, PO's arguments overlook other portions of the specification where the mobile unit does not communicate directly with the network. *See, e.g.,* EX1001, 3:21-36 (describing that "the mobile unit does not receive communications from the fixed port but only from the movable base station," and "eliminating any direct communication from the mobile unit to the fixed radio port."); 4:48-54. Thus, PO's attempt to limit "*mobile device*" to a specific embodiment(s) in the specification is improper. *See Superguide Corp.*, 358 F.3d at 875.

'023 Petitioner's Reply, Paper 19, pp. 6-7.

Disputed Issues – Claim Construction "Automotive Vehicle"

Proposed Construction of "Automotive Vehicle"	
VWGoA	Patent Owner
"Plain and Ordinary Meaning"	"automobile"
Alternatively: "a vehicle moving by means of its own power"	

'023 POR, Paper 12, p. 16-17; '023 Denning Reply Decl., EX1034, ¶28.

Petitioner's Demonstrative Exhibit
Not Evidence

Disputed Issues – Claim Construction "Automotive Vehicle"

VWGoA's Argument – No construction needed

> It is well-settled that "Ordinary, simple English words whose meaning is clear and unquestionable, absent any indication that their use in a particular context changes their meaning, are construed to mean exactly what they say." *Chef America, Inc. v. Lamb-Weston, Inc.*, 358 F.3d 1371, 1372, (Fed. Cir. 2004). Such

'023 Petitioner's Reply, Paper 19, p. 9.

Disputed Issues – Claim Construction "Automotive Vehicle"

VWGoA's Alternative Construction –
"a vehicle moving by means of its own power"

184. Gilhousen865 discloses that the repeater 210 ("*apparatus*") is mounted in an airplane ("*automotive vehicle*"). For example, according to Webster's New World Dictionary published in 1993, a vehicle is defined as: "any device or contrivance for carrying or conveying persons or objects, esp. over land or in space," and even provides "spacecraft" as an example. Meanwhile, the term "automotive" is defined as "self-moving" or "moving by means of its own power". Webster, Ex. 1033, 93, 1479. An airplane, like a car, is self-moving since it is pushed and moved by its own engine. Thus, "automotive vehicle" was clearly understood at the time of the '023 patent to include airplanes. Ex. 1009,

'023 Denning Decl., EX1003, ¶184; '023 Pet., Paper 2, p. 64..

Petitioner's Demonstrative Exhibit
Not Evidence

Disputed Issues – Claim Construction
"Automotive Vehicle"

Carucel's Argument

An "automotive vehicle" travels along a roadway. The specification is referring to an automobile. Additionally, the '023 Patent provides that "a mobile communication system employs moving base stations moving in the direction of **flow of traffic moving along a roadway**." (Ex. 1001, Abstract (emphasis added). An "automotive vehicle" must travel along the roadway as described in the specification of the '023 Patent. A person of ordinary skill in the art would understand the term "automotive vehicle" to mean an automobile. *See id.*

'023 POR, Paper 12, p. 16.

Petitioner's Demonstrative Exhibit
Not Evidence

Disputed Issues – Claim Construction "Automotive Vehicle"

VWGoA's Reply

limitations from the specification. PO points to the specification, which states that "[t]he moving base stations 30 may be moved by means of a…suitable conveying device which **may** include an automotive vehicle traveling on the roadway." POR, 16, (emphasis added). However, this language is not mandatory, but permissive. Therefore, it does not evidence that "[a]n 'automotive vehicle' **must** travel along the roadway." *Id.* (emphasis added). As such, it does not rise to the level of a "clear

'023 Petitioner's Reply, Paper 19, p. 9.

Petitioner's Demonstrative Exhibit
Not Evidence

Disputed Issues – Ito + Gardner
Ito discloses "mobile device"

Ito Discloses the Plain and Ordinary Meaning of "mobile device," as well as VWGoA's alternative construction

118. As shown in Ito's Fig. 1, a mobile base device MSS ("*apparatus*") facilitates communication between a base station BSS2 ("*fixed port*") and a portable device PSS ("*mobile device*") located within a vehicle. Whereas the first

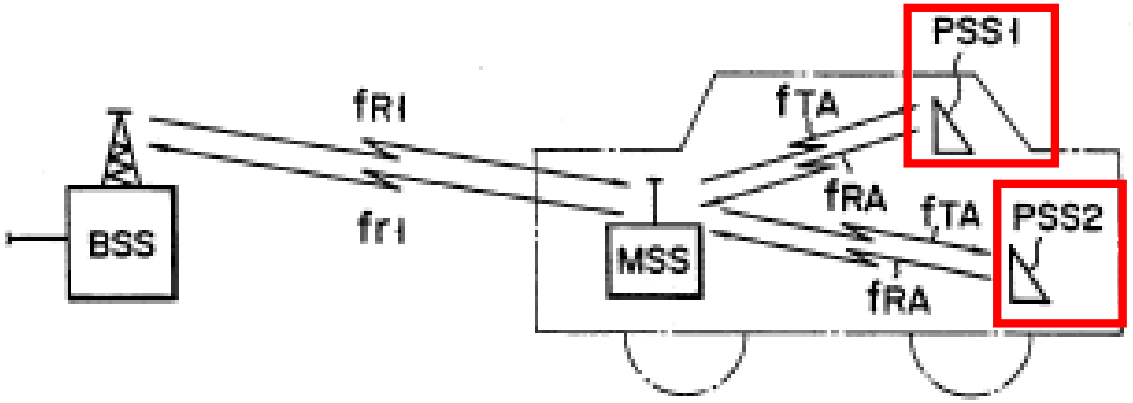


FIG. 6

'023 Denning Decl., EX1003, ¶118; Ito, EX1005, FIG. 6 (annotated); '023 Pet., Paper 2, p. 35..

Disputed Issues – Ito + Gardner
Ito discloses "mobile device"

Carucel's Argument

In contrast, *Ito* does not disclose any ability of its portable device to register or directly communicate with a cellular network.[20] *See* Lanning Decl. ¶147. Rather, *Ito's* portable device is similar to a cordless phone system. *Id*. *See Ex. 1005* at 3:36-41 (Alternatively in a second possible application that uses a system according to the invention for a cordless telephone system, a mobile base device, may be constituted by a stationary unit of a cordless telephone system while a portable device may correspond to a cordless 40 telephone handset); *Id*. at 3:54-56 (With such

'023 POR, Paper 12, p. 44.

Disputed Issues – Ito + Gardner
Ito discloses "mobile device"

Ito Discloses "mobile device" even under PO's proposal

amplifier (PA) 16 and an antenna 18. EX1005, 6:3-8. Ito also discloses that "radio transmission signals coming out from said power amplifier 16 are forwarded to the antenna 18, which sends them out **to a corresponding base station BSS**." *Id.*, 6:32-35. Ito also discloses that the PSS includes a control system having an "electric field strength sensor circuit 33 [which] senses the received field strength of the electric wave transmitted **from the base station BSS [to which] it belongs**." *Id.*, 6:65-7:1. This sensor would be superfluous if Ito's PSS only received signals from the mobile base device MSS. As discussed above, the

Denning Reply Decl., EX1034, ¶36.

Even if Ito does not explicitly disclose that its PSS can directly communicate and register with the cellular network, a POSA would have recognized Ito as implying this functionality. For example, Ito discloses its invention in the context of known "cellular type automobile telephone system[s]." EX1005, 1:8-17. Ito also discloses that its MSS can designate a transmission frequency and time slot allocation to the PSS using the control channel. *Id.*, 11:39-44. This is also indicative of a cellular communication system. EX1034, ¶38. Thus, a POSA would have understood that Ito's system could support cellular communications, which necessarily includes direct communication and registration with the cellular network.

'023 Petitioner's Reply, Paper 19, p. 13.

Disputed Issues – Ito + Gardner
Ito Discloses "mobile device"

Carucel's Expert's Admission

Further, PO's expert, Mr. Lanning, confirmed that the claimed "*mobile device*" is the same as that discussed in the Background section of the '023 patent. *See* EX1039, 112:3-11; *see generally* EX1039, 104:12-116:19. Mr. Lanning relies on the Background disclosure to support PO's proposed construction, EX2100, ¶55, and acknowledges that these mobile devices operate in a "conventional manner," *id.*, ¶52. Thus, by Mr. Lanning's own admissions, a POSA would have known that the claimed "*mobile device*" is not new, and that such a conventional mobile device could be used in Ito's system. EX1034, ¶39.

'023 Pet. Reply, p. 14.

Disputed Issues – Ito + Gardner
Gardner Discloses Selecting a "best signal"

Gardner Discloses the Plain and Ordinary Meaning of Selecting a "best signal" (Dependent Claim 16)

121. As discussed above, Ito in view of Gardner discloses "*a receiver configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas*." *See* Section XI.B.2. Gardner discloses that, while there are many well-known ways to make use of the signals received from the multiple antennas, "[t]he simplest of these is to just chose [sic] the antenna that provides the strongest signal." Ex. 1006, 1:25-27. In order to identify the

'023 Denning Decl., ¶121.

'023 Pet., pp. 36-37; '023 Pet. Reply, pp. 14-15.

Disputed Issues – Ito + Gardner
Gardner Discloses Selecting a "best signal"

Carucel's Argument

In contrast, the '023 Patent provides that "a best signal" is more than just the strongest signal: "[t]he procedures for determining whether a mobile unit is to be served by a fixed base station or a moving base station are the same procedures as described earlier herein in determining which moving base station is selected to serve a mobile unit, i.e., based on signal strength and error rate." Ex. 1001 at 11:3-8. At a minimum, 'best signal' includes an analysis of the error rate in addition to the signal strength when viewed in the entire context of the '023 Patent. *See* Lanning Decl. ¶ 153.

'023 POR, p. 47.

VWGoA's Reply

42. Meanwhile, the portion of the '023 patent cited by Patent Owner clearly relates to handoff decision-making *at the mobile device*. I reproduce that citation in full below:

'023 Denning Reply Decl., ¶42.

45. Gardner discloses that "[t]here are many well known schemes for making use of the signals from the two antennas." EX1006, Gardner, 1:25-26. In one such scheme, Gardner discloses "maximal ratio coherent combining" in which signals from two antennas are "aligned in phase, **weighted with gains proportional to their signal voltage to noise power ratios**, and summed." *Id.*, 1:32-34. A POSA would have understood that there is a 1-to-1 mapping between signal-to-noise ratio and error rate for a given modulation and coding. In other words, each value of error rate corresponds to a specific signal-to-noise ratio, and vice versa. *See, e.g.*, EX1047, Pyndiah, 1042 (Figures 4-6 graphing the one-to-one

'023 Denning Reply Decl., ¶45.

'023 Pet. Reply, pp. 15-16.

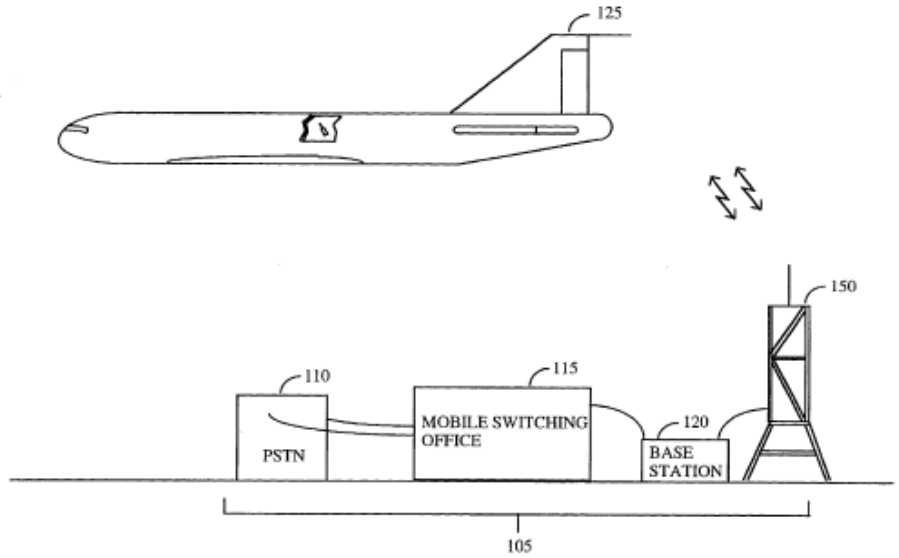
Petitioner's Demonstrative Exhibit
Not Evidence

Disputed Issues – Gilhousen865 + Gilhousen390
Gilhousen865 Discloses "an apparatus configured to move relative to Earth"

166. As discussed above, Gilhousen865 describes a repeater 210 ("*apparatus*") installed in an airplane that functions both to provide outgoing calls from the radiotelephone to the ground base station, and incoming calls originating from the ground subsystem to the airborne radiotelephone. *See* Ex. 1009, 2:53-63. Because the repeater is installed in an airplane, it would have been obvious to a POSITA that the repeater is "*configured to move relative to Earth*."

'023 Denning Decl., ¶166.

FIG. 1



Gilhousen865, FIG. 1.

'023 Pet., pp. 56, 59; '023 POR, pp. 51-52; '023 Pet., Paper 2, p. 56..

Disputed Issues – Gilhousen865 + Gilhousen390
Gilhousen865 Discloses "an apparatus configured to move relative to Earth"

Carucel's Argument

> airplane. Petition at 56; Ex. 1003 ¶166. *Gilhousen865* does not disclose an apparatus constructed to move with the traffic at a rate of speed which is comparable to the speed of the traffic as required by the limitation of a "configured to" in the context of the entire '023 Patent. *See Philips v. A.W.H. Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005). An airplane does not move with traffic as it is not bound to predetermined roads. Lanning Decl. ¶48. Additionally, an airplane can travel at speeds up to five hundred miles-per-hour and, as such, does not move with the traffic at a rate of speed which is comparable to the traffic. *See* Lanning Decl. ¶118.

'023 POR, pp. 51-52.

Disputed Issues – Gilhousen865 + Gilhousen390
Gilhousen865 Discloses "an apparatus configured to move relative to Earth"

VWGoA's Reply

50. First, I note that the language "bound to predetermined roads" does not appear in the claims or in Patent Owner's proposed construction for "*configured to*." Second, it appears that the only support provided by Patent Owner for the addition of "bound to predetermined roads" into the claim is Mr. Lanning's declaration. But, based on my review, Mr. Lanning's declaration never states or provides any other support for the contention that "traffic" is limited to predetermined roads.

'023 Denning Reply Decl., ¶50.

52. Further still, in my opinion, the requirement of "predetermined roads" contradicts the ordinary and customary meaning of the term "traffic." "Traffic" is not a term of art, and does not appear to have any specific meaning in the context of the '023 patent, as evidenced by the various types of traffic described in the '023 patent. And this term had a common and well-known understanding at the time of the '023 patent. For example, dictionaries at the time defined "traffic" as "vehicles moving on a public highway, **in the air**, or at sea." EX1036, Oxford Desk Dictionary, 611. Gilhousen865's airplane certainly meets this definition. And a POSA would have understood that Gilhousen865's airplane is a vehicle moving in the air. Therefore, it is my opinion that Patent Owner's proposed interpretation

54. First, airplanes often travel along predetermined roads, such as during taxi, takeoff and landing. *See, e.g.*, EX1045, FAA Runway Safety, 35 (explaining that "roadways bounded by 'zipper' markings are also used by aircraft"); *see also id.*, 32-39 (generally showing airfield boundaries for use by airplanes). Second, Gilhousen865's teachings are not unique to an airplane. Rather, Gilhousen865

'023 Denning Reply Decl., ¶¶52, 54.

'023 Pet. Reply, pp. 16-18.

Disputed Issues – Gilhousen865 + Gilhousen390
Gilhousen865 Discloses a "mobile device"

Gilhousen865 Discloses the Plain and Ordinary Meaning of "mobile device."

172. Gilhousen865 explains that the repeater receives signals ("*fixed port signals*") from the ground base station ("*fixed port*"), and then "[t]he signals from the ground base stations are received by the external antenna of the airborne subsystem and repeated to the radiotelephones [("*mobile device*")]." Ex. 1009, 3:55-57. Because Gilhousen865 discloses sending the signals to the

'023 Denning Dec., ¶172.

55. I maintain that Gilhousen865 discloses the claimed "*mobile device*" under its ordinary and customary meaning. EX1003, ¶¶172-73. For example, Gilhousen865 discloses that its radiotelephone is both movable and that it sends and receives radiofrequency signals. *See, e.g.*, EX1009, 2:37-41, 2:27-31, 2:45-52, 3:38-40. Mr. Lanning does not appear to rebut this.

'023 Denning Reply Decl., ¶55.

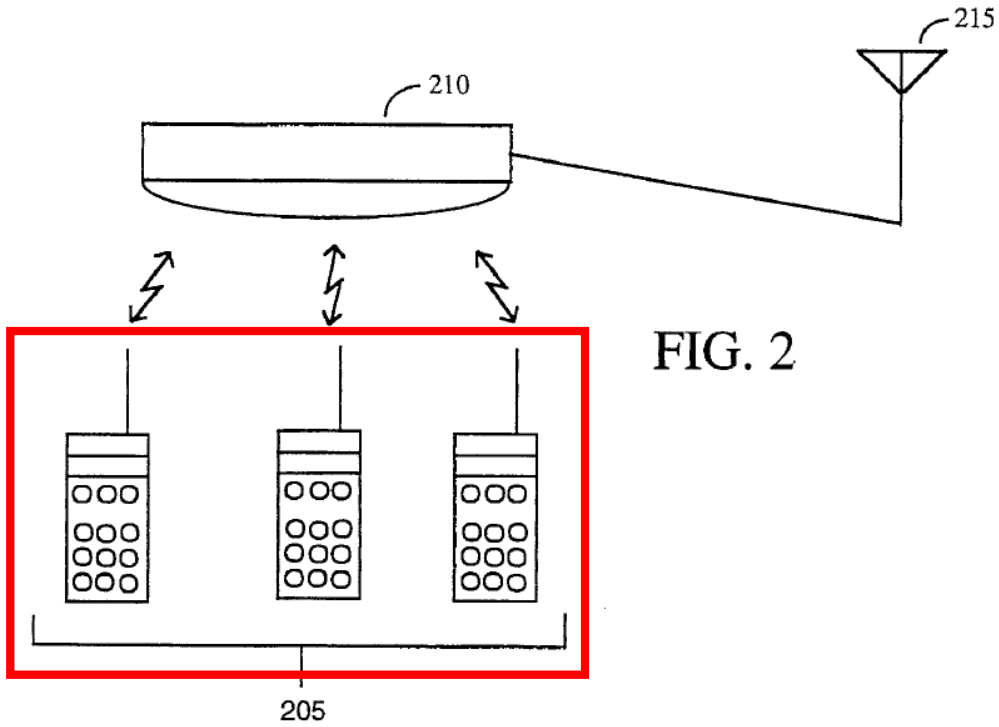


FIG. 2

Gilhousen865, FIG. 2 (annotated).

Petitioner's Demonstrative Exhibit
Not Evidence

'023 Pet., pp. 21, 60; '023 Pet. Reply, pp. 18-20; '023 POR, pp. 52-53.

Disputed Issues – Gilhousen865 + Gilhousen390
Gilhousen865 Discloses a "mobile device"

Carucel's Argument

(Petition at 60 citing Ex. 1009 at 3:55-57). While *Gilhousen865* does disclose radiotelephones, *Gilhousen865* does not disclose a transmitter configured to transmit radio frequency signals to a radiotelephone that registers with or is capable of directly communicating with the cellular network as required by the limitation of a "mobile device" in the context of the entire '023 Patent. *See Philips v. A.W.H. Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005).

'023 POR, pp. 52-53.

Disputed Issues – Gilhousen865 + Gilhousen390
Gilhousen865 Discloses a "mobile device"

Gilhousen865 Discloses "mobile device" Even Under PO's Proposal

58. Gilhousen865 discloses that its radiotelephone registers with a base station: "This enables the radiotelephones to search for the strongest pilot signal of the next cell and **register with that base station**." EX1009, 3:57-59; *see also id.*, Abstract, 3:3-10, 4:1-5. Mr. Lanning confirms this understanding, stating that "I would say as far as the network is concerned … the radiotelephone is registered with the network …." EX1040, 334:12-335:5; *see also id.*, 343:5-9. Additionally, Gilhousen865 discloses that traditional aircraft radiotelephones "connect[] with one of 70-80 radiotelephone base stations, also known as cells, **on the ground**. The cell to which it connects depends on to which base station the aircraft is closest when the call is initiated." EX1009, 1:17-23. Thus, these radiotelephones

'023 Denning Reply Decl., ¶58.

But, even if Gilhousen865 does not explicitly disclose that its radiotelephones register and directly communicate with the cellular network, a POSA would have recognized Gilhousen865 as implying this functionality. For example, Gilhousen865 discloses that the radiotelephone operates using the Telecommunications Industries Association/Electronic Industries Association Interim Standard 95 (TIA/EIA/IS-95), a well-known cellular telephone standard at the time that enabled registration and direct communication with the cellular network. EX1009, 2:65-3:2; EX1034, ¶59. Additionally, Gilhousen865 discloses its system is a CDMA cellular radiotelephone system, EX1009, 2:13-15, which allows for communications with "ground based **cellular** radio systems," *id.*, Abstract, having antennas that are "identical to typical cell site antennas that are

'023 Pet. Reply, p. 19.

'023 Pet. Reply, pp. 19-20.

Disputed Issues – Gilhousen865 + Gilhousen390
Gilhousen865 Discloses an "automotive vehicle"

Gilhousen865 Discloses the Plain and Ordinary Meaning of "automotive vehicle" (Dependent Claim 20)

184. Gilhousen865 discloses that the repeater 210 ("*apparatus*") is mounted in an airplane ("*automotive vehicle*"). For example, according to Webster's New World Dictionary published in 1993, a vehicle is defined as: "any device or contrivance for carrying or conveying persons or objects, esp. over land or in space," and even provides "spacecraft" as an example. Meanwhile, the term "automotive" is defined as "self-moving" or "moving by means of its own power". Webster, Ex. 1033, 93, 1479. An airplane, like a car, is self-moving since it is pushed and moved by its own engine. Thus, "automotive vehicle" was clearly understood at the time of the '023 patent to include airplanes. Ex. 1009, 2:45-49. Therefore, Gilhousen865 discloses "*wherein the vehicle is an automotive vehicle.*"

'023 Pet., p. 64.

'023 Denning Decl., ¶184.

Petitioner's Demonstrative Exhibit
Not Evidence

Disputed Issues – Gilhousen865 + Gilhousen390
Gilhousen865 Discloses an "automotive vehicle"

Carucel's Argument

> Mr. Denning's analysis of "automotive vehicle" is flawed as his own example demonstrates the confusion he has with Claim 19—"wherein the apparatus is conveyed by a vehicle." Under Mr. Denning's analysis, there is no distinction between a "vehicle" and an "automotive vehicle." Mr. Denning stated that a "spacecraft" is an example of a vehicle while an automotive vehicle "mov[es] by means of its own power." There is no difference. A spacecraft certainly moves by means of its own power. The doctrine of claim differentiation provides a presumption that differently worded claims cover different claim scope. *Wi-LAN USA, Inc. v. Apple Inc.*, 830 F.3d 1374, 1391 (Fed. Cir. 2016). As Patent Owner has stated, "automotive vehicle" is automobile. An airplane is a vehicle. To apply Petitioner and Mr. Denning's interpretation would violate the presumption of claim differentiation.

'023 POR, pp. 54-55.

Disputed Issues – Gilhousen865 + Gilhousen390
Gilhousen865 Discloses an "automotive vehicle"

Gilhousen865 discloses "automotive vehicle" even under Carucel's Alternative Construction.

62. As discussed above, Gilhousen865's teachings are not unique to an airplane. Rather, Gilhousen865 discloses radio telephones on board a moving vehicle that communicate with a base station via a moving base station system having an antenna located on the outside of the vehicle. Gilhousen865 further discloses that "[T]he airborne communication system of the present invention operates in a similar way to the ground based CDMA radiotelephone system discussed in Gilhousen et al." EX1009, 3:11-13. This concept is equally applicable to other vehicles, including automobiles, and would have provided the same or similar benefits as the airplane-based system of Gilhousen865. A POSA would

'023 Denning Reply Decl., ¶62.

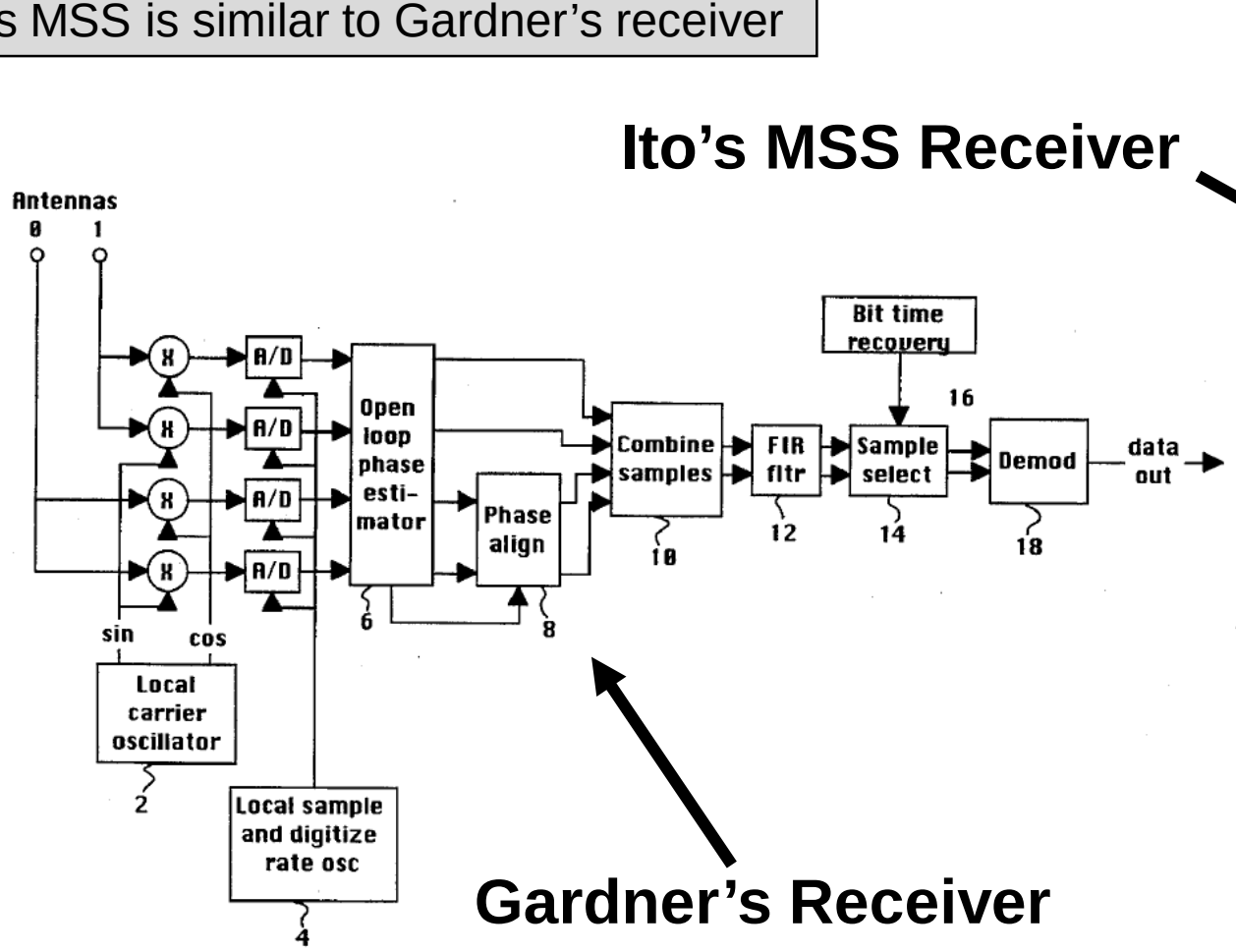
incorrect. According to my reading of the claims, claims 19 and 20 define a genus/species relationship between the terms "*vehicle*" and "*automotive vehicle*" because claim 20 recites that "*the vehicle* [(of claim 19)] *is an automotive vehicle*." Thus, to satisfy the "*automotive vehicle*" limitation of claim 20, the device must also, **by definition**, be a "*vehicle*," as required by claim 19. I was fully aware of claim differentiation when I prepared my previous declaration, and I understood that many non-automotive vehicles existed (e.g., wagons, strollers, trailers, bicycles, etc.) that would satisfy claim 19 without satisfying claim 20. But Gilhousen865's airplane satisfies both.

'023 Denning Reply Decl., ¶63.

'023 Pet. Reply, pp. 20-21.

Disputed Issues – Motivation to Combine Ito + Gardner

Ito's MSS is similar to Gardner's receiver



Gardner's Receiver

Ito's MSS Receiver

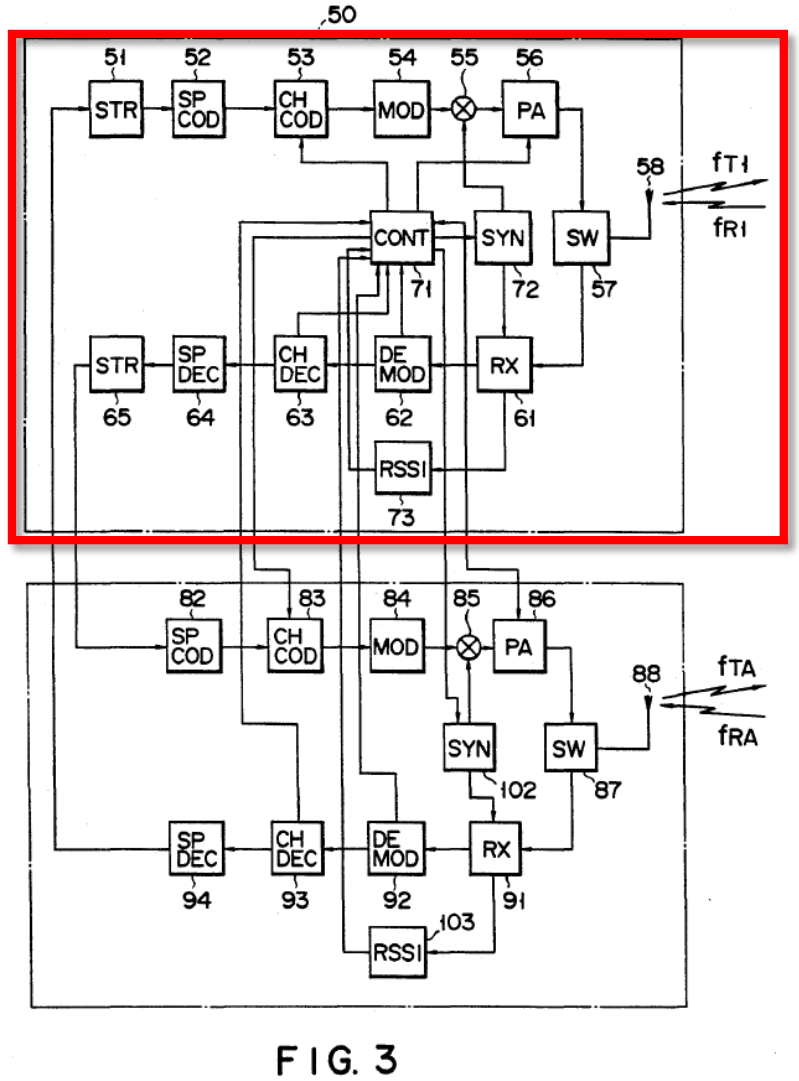


FIG. 3

Gardner, FIG. 1; Ito, FIG. 3 (annotated).

Petitioner's Demonstrative Exhibit Not Evidence

'023 Pet., pp. 26-28, 31-34; '023 Pet. Reply, pp. 21-23; '023 POR, pp. 36-37.

Disputed Issues – Motivation to Combine Ito + Gardner

Ito acknowledges the problem of "high speed fading phenomena."

> 103. Ito discloses that signals transmitted to a moving device often have higher error rates due to "high speed fading phenomena." *Id.*, 16:49-61. However, Ito does not specifically describe how such errors can be reduced. Therefore, a POSITA would have looked to the prior art, such as Gardner, for determining how to combat the deleterious effects of fading on signals transmitted to a moving device. As discussed in Section VII.E, A POSITA would

'023 Denning Decl., ¶103.

'023 Pet., pp. 26-27.

Disputed Issues – Motivation to Combine Ito + Gardner

Gardner discloses a solution to the problem of fading: spatial diverse antennas

104. Like Ito, Gardner discloses a receiver for use in a wireless communication system. However, Gardner emphasizes the importance of employing spatially diverse antennas in the receiver to reduce the effects of fading on received signals. *See* Ex. 1006, 1:15-24. Specifically, Gardner discloses that "[o]ne of the most useful techniques for improving receiver performance…is to use spatial diversity." *Id.*, 1:15-17. According to Gardner, spatial diversity reduces the effect of fading encountered by the received signal and provides "[c]onsiderable performance improvement." *Id.*, 1:19-23.

'023 Denning Decl., ¶104.

'023 Pet., pp. 26-27.

Petitioner's Demonstrative Exhibit
Not Evidence

Disputed Issues – Motivation to Combine Ito + Gardner

Exemplary combination of Ito and Gardner

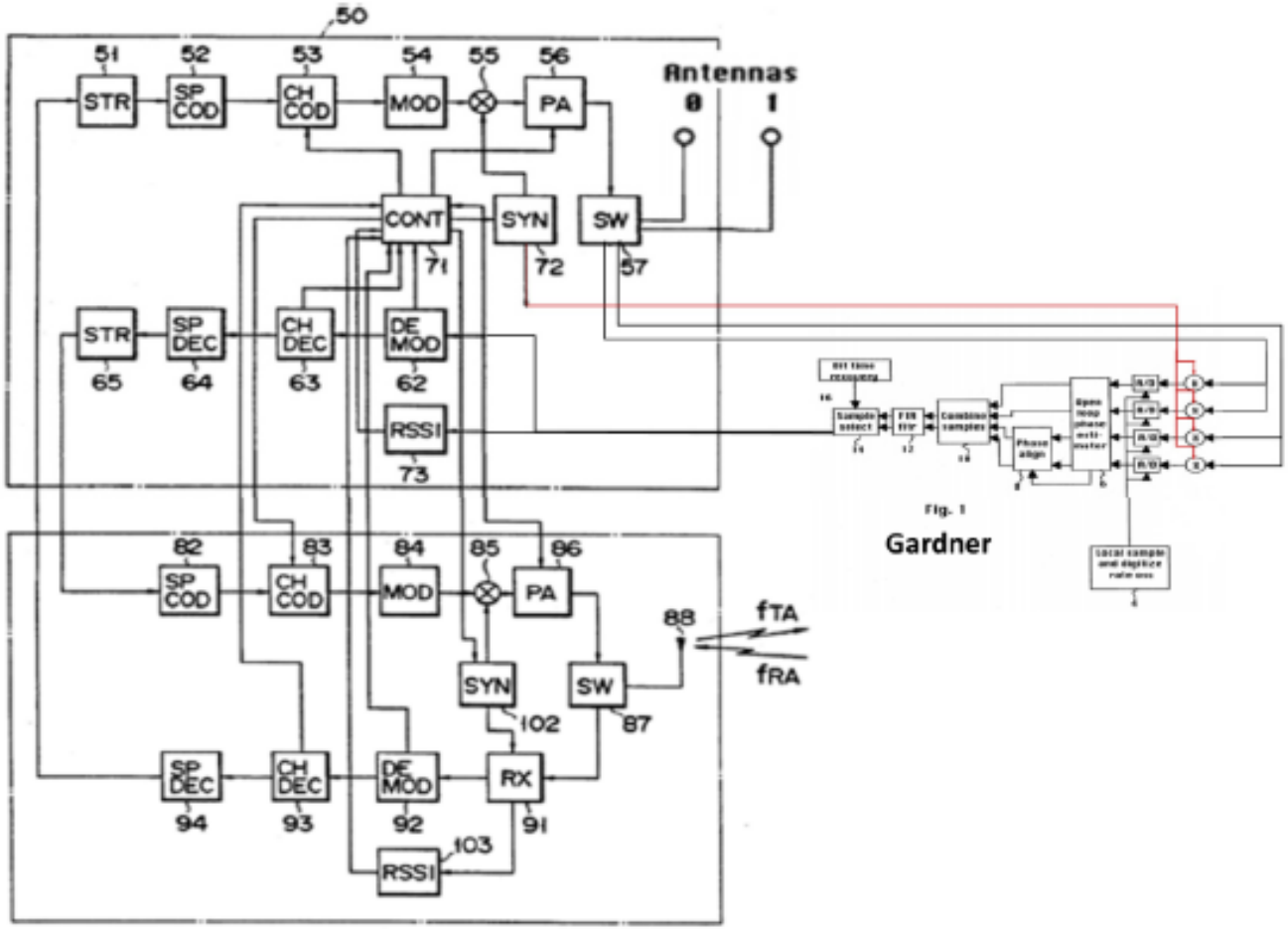


FIG. 3 Ito

Fig. 1

Gardner

’023 Denning Decl., ¶105; Ito, FIG. 3 and Gardner, FIG. 1 (annotated).

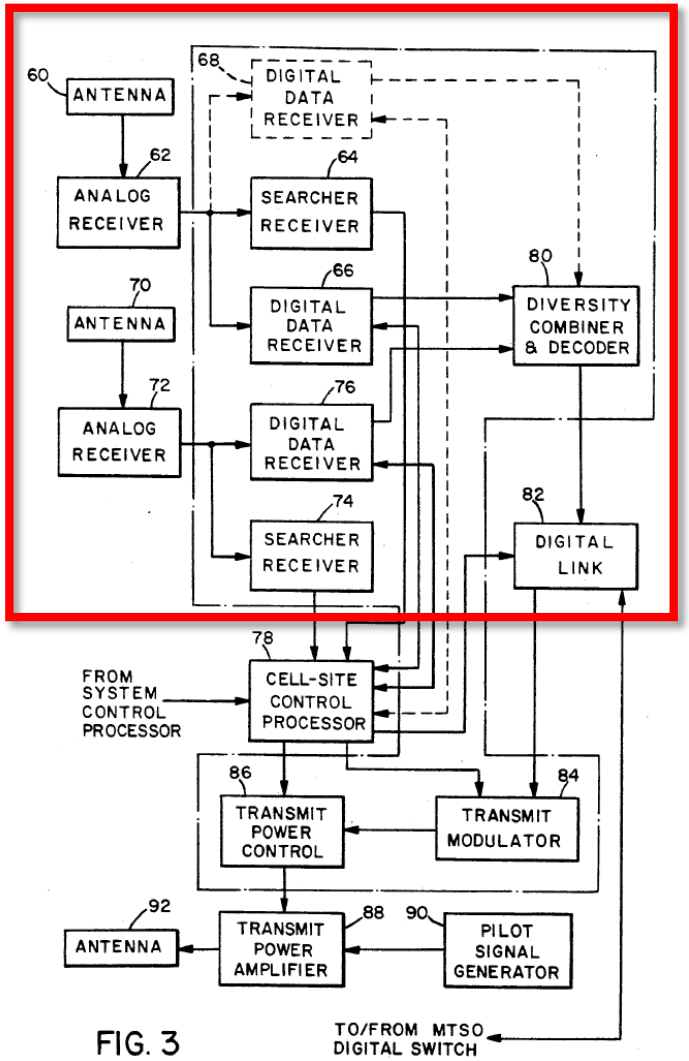
Petitioner’s Demonstrative Exhibit
Not Evidence

’023 Pet., p. 27; ’023 Pet. Reply, p. 22.

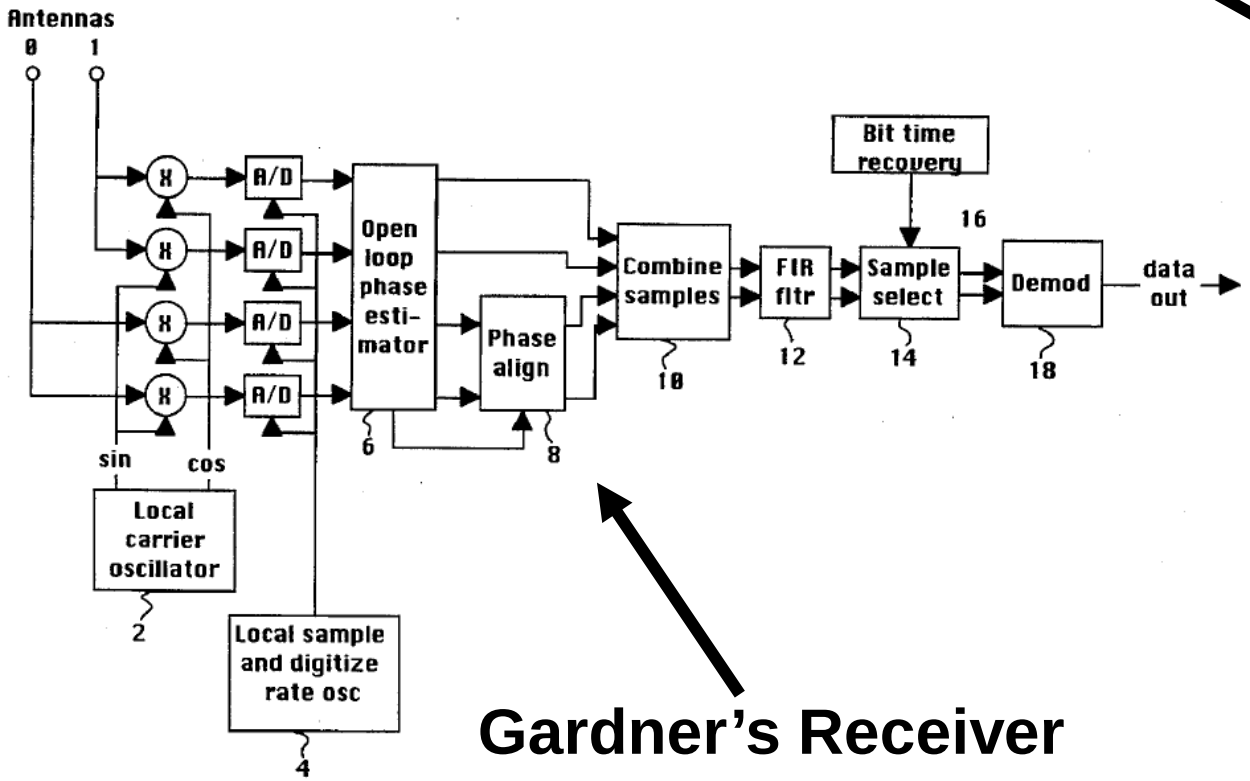
Disputed Issues – Motivation to Combine Ito + Gardner + Gilhousen390

Gilhousen390's receiver is similar to Gardner's receiver

Gilhousen390's Receiver



Gardner's Receiver



Gardner, FIG. 1; Gilhousen390, FIG.3 (annotated).

Petitioner's Demonstrative Exhibit Not Evidence

'023 Pet., pp. 23, 42-45; '023 Pet. Reply, pp. 23-24; '023 POR, pp. 37-38.

Disputed Issues – Motivation to Combine Ito + Gardner + Gilhousen390

Gardner acknowledges the difficulty of "align[ing] the phases"

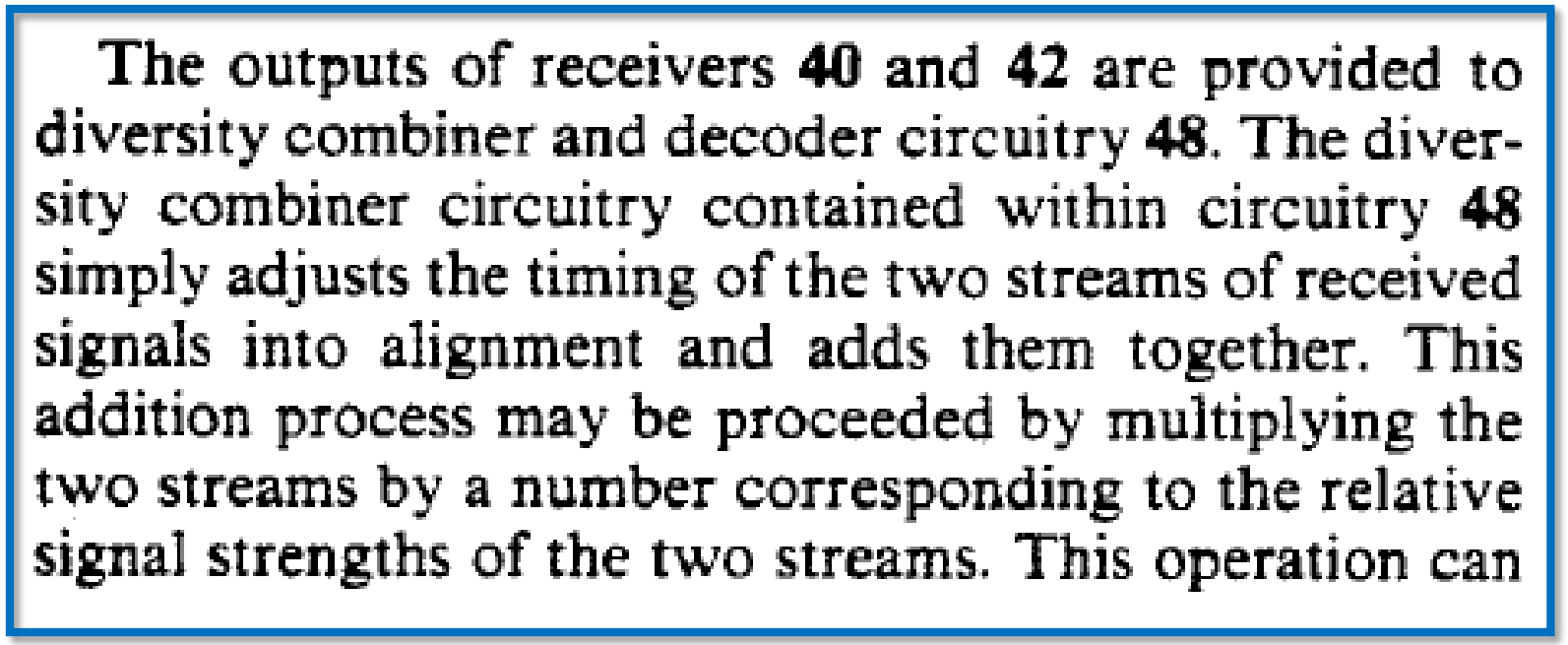
> the most difficult aspect of the problem is determining how to align the phases. The problem is inherently very similar to designing a phase tracking circuit for coherent demodulation. A circuit or algorithm must be developed that determines the phase difference between the two signals at any given time, removes the difference from one of the two, and then sums the vectors.

Gardner, 1:38-44.

'023 Pet., pp. 43-44.

Disputed Issues – Motivation to Combine Ito + Gardner + Gilhousen390

Gilhousen390 discloses a solution to the problem of “align[ing] the phases”



The outputs of receivers **40** and **42** are provided to diversity combiner and decoder circuitry **48**. The diversity combiner circuitry contained within circuitry **48** simply adjusts the timing of the two streams of received signals into alignment and adds them together. This addition process may be proceeded by multiplying the two streams by a number corresponding to the relative signal strengths of the two streams. This operation can

Gilhousen390, 13:21-28.

’023 Pet., pp. 43-44, 46.

Disputed Issues – Motivation to Combine Ito + Gardner + Gilhousen390

Carucel argues FDMA/TDMA is incompatible with CDMA

signals from a second base station BSS." (Ex. 1003, ¶ 141). Yet, Mr. Denning's Declaration never actually explains why Fig. 3 of *Gilhousen390's* components utilizing CDMA modulation techniques would be applicable to *Ito's* components utilizing FDMA/TDMA modulation techniques. Critically, Mr. Denning's Declaration fails to even address any compatibility issues that would arise when trying to implement *Gilhousen390's* CDMA functionality into *Ito's* receiver that is designed for a FDMA/TDMA system, much less offer any explanation as to how to resolve these compatibility issues, or whether there is a reasonable expectation of success in light of these compatibility issues. *See* Lanning Decl. ¶¶ 82-83.

'023 POR, p. 29.

Disputed Issues – Motivation to Combine Ito + Gardner + Gilhousen390

FDMA/TDMA is compatible with CDMA: (1)

system which would have prevented the proposed combination. POR, 37-38. But Ito discloses that "while a FDMA/TDMA technique is employed for radio channels connecting base stations and mobile base devices as well as mobile base devices and portable devices, a FDMA or TDMA technique may be used in its place."

65. In fact, such combinations were well-known in the art and should have been recognized by Mr. Lanning based on his past reliance on a document describing combined CDMA techniques. In particular, it is my understanding that

'023 Denning Reply Decl., ¶¶64-65.

'023 Pet. Reply, pp. 23-24.

Disputed Issues – Motivation to Combine Ito + Gardner + Gilhousen390

FDMA/TDMA is compatible with CDMA: (2)

describing combined CDMA techniques. In particular, it is my understanding that Mr. Lanning previously relied on a document entitled "Digital Cellular Land Mobile Telecommunication Systems" from the International Telecommunication Union ("ITU"). This document expressly discloses that CDMA can be combined with both TDMA and FDMA in PCS digital communication RF links. EX1038, 36; EX1035, Lanning Barkan Decl., ¶67. ITU further discloses several benefits of combining TDMA, FDMA, and CDMA, such as "help[ing] mitigate the PCS link performance degradation caused by multipath propagation conditions" and "help[ing] mitigate problems of interference." EX1038, 33. Mr. Lanning appears to

'023 Denning Reply Decl., ¶65.

'023 Pet. Reply, pp. 23-24.

Disputed Issues – Motivation to Combine Ito + Gardner + Gilhousen390

FDMA/TDMA is compatible with CDMA: (3)

The composite CDMA/TDMA (CCT) system provides an architecture that is optimized for PCS, utilizing specific benefits of FDMA, TDMA, and CDMA technologies to provide multiple user access to the PCS network.

The system employs direct sequence spread spectrum (DSSS) with TDMA, FDMA, and CDMA for PCS digital communications RF links. The use of the combined technologies will:

– help mitigate the PCS link performance degradation caused by multipath propagation conditions experienced in typical mobile PCS environments.

– help mitigate problems of interference with OFS users near the PCS operating area.

The technology can:

– accommodate the full range of mobile handover conditions, including those at freeway speed;

ITU, ’023 EX1038, p. 33.

’023 Pet. Reply, pp. 23-24.

Disputed Issues – Motivation to Combine Gilhousen865 + Gilhousen390

Gilhousen865's system is similar to Gilhousen390's system

Gilhousen390's System

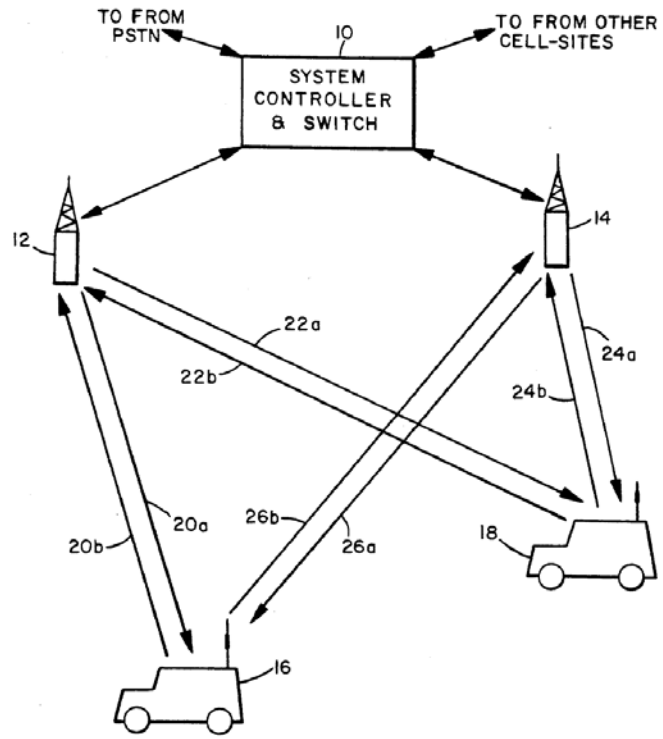
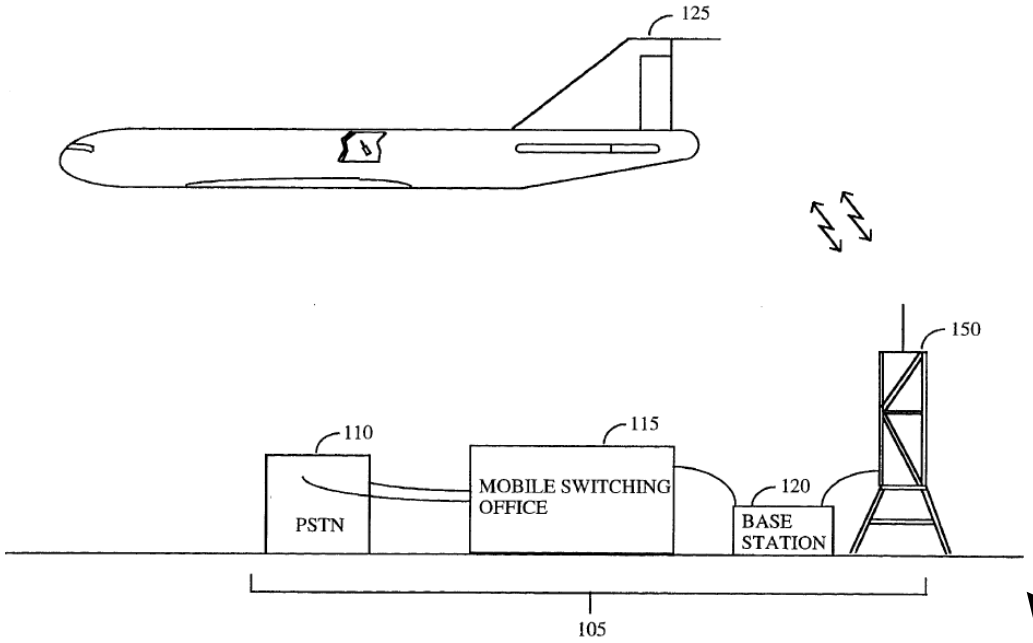


FIG. I

FIG. 1



Gilhousen865's System

Gilhousen865, FIG. 1; Gilhousen390, FIG.1.

Petitioner's Demonstrative Exhibit Not Evidence

'023 Pet., pp. 44, 51-56; '023 Pet. Reply, pp. 24-25; '023 POR, pp. 39-41.

Disputed Issues – Motivation to Combine Gilhousen865 + Gilhousen390

Gilhousen865's system suffers from a well-known fading problem

> 159. Deleterious effects on wirelessly-transmitted signals, such as fading, interference, and other degradations to signal quality were well-known at the time of the '023 patent. For example, as I discussed in Section VII.E, Calhoun disclosed the effect of multipath fading. In addition, Mottl proposed a statistical

'023 Denning Decl., ¶159.

'023 Pet., p. 53.

Disputed Issues – Motivation to Combine Gilhousen865 + Gilhousen390

Gilhousen390 discloses a solution to the fading problem

associated with moving vehicles. *See, e.g.*, Ex. 1007, Fig. 1. Specifically, Gilhousen390 explains that fading, a common negative effect a signal quality in wireless transmissions, can be especially profound with respect to signals transmitted to/from a vehicle. *Id.*, 3:17-22. In order to counter the negative effects of fading, Gilhousen390 describes employing various configurations to achieve signal diversity at the receiver. In one such example, Gilhousen390 describes

'023 Denning Decl., ¶160.

'023 Pet., p. 53-54.

Disputed Issues – Motivation to Combine Gilhousen865 + Gilhousen390

Carucel's Argument

A POSITA would not have been motivated to combine *Gilhousen390's* CDMA signal diversity configurations with *Gilhousen865's* airborne repeater because the combination would suffer from the same issues that the Gilhousen865 invention was attempting to overcome—"[T]he aircraft radiotelephone system does not perform hand-offs . . . . [and] results in the call from the aircraft radiotelephone being dropped when the aircraft reaches the limit of the cell's coverage." Ex. 1009 at 36-41. Critically, Gilhousen390's CDMA signal diversity configurations will not work if employed on *Gilhousen865's* high speed airborne repeater, because *Gilhousen390's* CDMA signal diversity configuration cannot increase the power of *Gilhousen865's* airborne repeater fast enough to compensate for the transmitted signal fading that is occurring on the connection with the base station due to the high speed of *Gilhousen865's* airborne repeater. *Id.* at ¶¶ 134-138. Therefore, with this combination, any calls in progress will be dropped because handovers cannot occur. *Id.*

'023 POR, p. 39.

Petitioner's Demonstrative Exhibit
Not Evidence

Disputed Issues – Motivation to Combine Gilhousen865 + Gilhousen390

VWGoA's Reply

the speed of the aircraft. POR, 39-41. But Patent Owner's argument overlooks that Gilhousen865's communication system *is* a CDMA communication system that uses a "CDMA-type radiotelephone." EX1009, 2:13-15, 2:46-52. As such, Gilhousen865's CDMA communication system would have considered the power control and other features of CDMA systems to operate in its preferred environment – on a plane.

'023 Denning Reply Decl., ¶67.

68. I further note that Patent Owner's argument appears to be based on a presumed rate of speed of an airplane (e.g., "500 miles-per-hour")[4]. POR, 40. This speed seems significantly exaggerated to me. Gilhousen865 discloses that the airborne based subsystem could be "in a small aircraft." EX1009, 2:56-59. Mr.

...

from before the earliest filing date of the '023 patent suggesting that small aircraft, such as a Cessna, available around the time of the '023 patent were capable of far lower speeds (e.g., "31 knots" (~36 MPH)) than suggested by Patent Owner. *See* EX1037, Cessna, 0069. This speed is even less than the "50 MPH" average speed of a vehicle deemed acceptable by Mr. Lanning.EX2100, ¶118. Thus,

'023 Denning Reply Decl., ¶68.

'023 Pet. Reply, pp. 24-25.

’023 Patent – All Elements Disclosed or Obvious

IPR2019-01103 (’023 Patent) – Claim 11
11. An apparatus configured to move relative to Earth, the apparatus comprising:
a plurality of spatially separated antennas; and
a receiver configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas; and
a transmitter configured to transmit radio frequency signals to a mobile device corresponding to the received fixed port signals.

’023 Pet., p. 7; ’023 DI., p. 30.

Petitioner’s Demonstrative Exhibit
Not Evidence

IPR2019-01102
’701 Patent

Instituted Grounds

IPR2019-01102 (’701 Patent)		
	Claim(s)	References
Ground 1	10, 15-18, 31, 33-35	Ito (EX1005) and Gardner (EX1006)
Ground 2	10, 15-18, 31, 33-35	Gilhousen865 (EX1009) and Gilhousen390 (EX1007)

’701 Pet., Paper 2, p. 6; ’701 DI., Paper 7, p. 28.

’023 Patent vs. ’701 Patent

IPR2019-01103 (’023 Patent) – Claim 11
11. An apparatus configured to move relative to Earth, the apparatus comprising:
a plurality of spatially separated antennas; and
a receiver configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas; and
a transmitter configured to transmit radio frequency signals to a mobile device corresponding to the received fixed port signals.

IPR2019-01103 (’023 Patent) – Claim 17
17. An apparatus in accordance with claim 11, further comprising a controller configured to align and combine the received radio frequency signals.

IPR2019-01102 (’701 Patent) – Claim 10
10. A movable base station configured to move relative to Earth, the movable base station comprising:
a plurality of spatially separated antennas;
a receiver configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas;
a controller configured to align and combine the received fixed port signals; and
a transmitter configured to transmit radio frequency signals to a mobile device corresponding to the received fixed port signals.

’701 Patent – Other Independent Claims

IPR2019-01102 (’701 Patent) – Claim 10
10. A movable base station configured to move relative to Earth, the movable base station comprising:
a plurality of spatially separated antennas;
a receiver configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas;
a controller configured to align and combine the received fixed port signals; and
a transmitter configured to transmit radio frequency signals to a mobile device corresponding to the received fixed port signals.

’701 Patent – Claim 31
31. A movable base station configured to move relative to Earth, the movable base station comprising:
a plurality of spatially separated antennas;
a receiver configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas; and;
a transmitter configured to transmit radio frequency signals to a mobile device corresponding to the received fixed port signals, the radio frequency signals transmitted within time slots of time-division multiplex channels.

’701 Patent, EX1001, Claims 10, 31.

’023 Patent and ’701 Patent
All Elements Disclosed or Obvious

IPR2019-01103 (’023 Patent) – Claim 11
10. An apparatus comprising:
a plurality of spatially separated antennas; and
a receiver configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas; and
a transmitter configured to transmit radio frequency signals to a mobile device corresponding to the received fixed port signals.

IPR2019-01102 (’701 Patent) – Claim 31
11. A movable base station configured to move relative to Earth, the movable base station comprising:
a plurality of spatially separated antennas; and
a receiver configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas;
a controller configured to align and combine the received fixed port signals; and
a transmitter configured to transmit radio frequency signals to a mobile device corresponding to the received fixed port signals.

’701 Pet., Paper 2, p. 6; ’701 DI., Paper 7, p. 28.

IPR2019-01105
’543 Patent

Petitioner’s Demonstrative Exhibit
Not Evidence

Instituted Grounds

IPR2019-01105 (’543 Patent)		
	Claim(s)	References
Ground 1	10, 12, 19-21, 23, 26, 44, 50-53	Ito (EX1004) and Paneth (EX1005)
Ground 2	13, 25, 45, 55	Ito, Paneth, and Gilhousen390 (EX1006)
Ground 3	18, 49	Ito, Paneth, and Gardner (EX1007)
Ground 4	54	Ito, Paneth, and Forssén (EX1008)

’543 Pet., Paper 2, p. 7; ’543 DI, Paper 8, pp. 7, 28.

’023 Patent vs. ’543 Patent

IPR2019-01103 (’023 Patent) – Claim 11
11. An apparatus configured to move relative to Earth, the apparatus comprising:
a plurality of spatially separated antennas; and
a receiver configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas; and
a transmitter configured to transmit radio frequency signals to a mobile device corresponding to the received fixed port signals.

IPR2019-01105 (’543 Patent) – Claim 10
10. An apparatus comprising:
a plurality of spatially separated antennas;
a receiver configured to receive, through the plurality of spatially separated antennas, a plurality of cellular signals from a plurality of base station interface circuits; and
a transmitter configured to transmit a mobile device radio frequency signal to a mobile device moving relative to Earth while the apparatus is moving relative to the plurality of base station radio interface circuits and relative to Earth, the mobile device radio frequency signal including data extracted from the cellular signals.

’543 Patent – Other Independent Claims

’543 Patent – Claim 10
10. An apparatus comprising:
a plurality of spatially separated antennas;
a receiver configured to receive, through the plurality of spatially separated antennas, a plurality of cellular signals from a plurality of base station interface circuits; and
a transmitter configured to transmit a mobile device radio frequency signal to a mobile device moving relative to Earth while the apparatus is moving relative to the plurality of base station radio interface circuits and relative to Earth, the mobile device radio frequency signal including data extracted from the cellular signals.

- **Claim 44 mirrors Claim 10**
- **Claim 52 mirrors Claim 21**

’543 Patent – Claim 21
21. An apparatus comprising:
a plurality of spatially separated antennas;
a first receiver configured to receive, through the plurality of spatially separated antennas, a cellular signal transmitted from a base station radio interface circuit;
a first transmitter configured to transmit a mobile device signal to a mobile device moving relative to Earth while the apparatus is moving relative to the base station radio interface circuit and in the same direction as the mobile device, the mobile device signal including data extracted from the cellular signal;
a second receiver configured to receive another mobile device signal transmitted from the mobile device; and
a second transmitter configured to transmit, using at least one of the plurality of spatially separated antennas, another cellular signal to the base station radio interface circuit while the apparatus is moving relative to the base station radio interface circuit and relative to Earth, the another cellular signal including other data extracted from the another mobile device signal.

’543 Pet., Paper 2, pp. 33-67.

Undisputed Issues

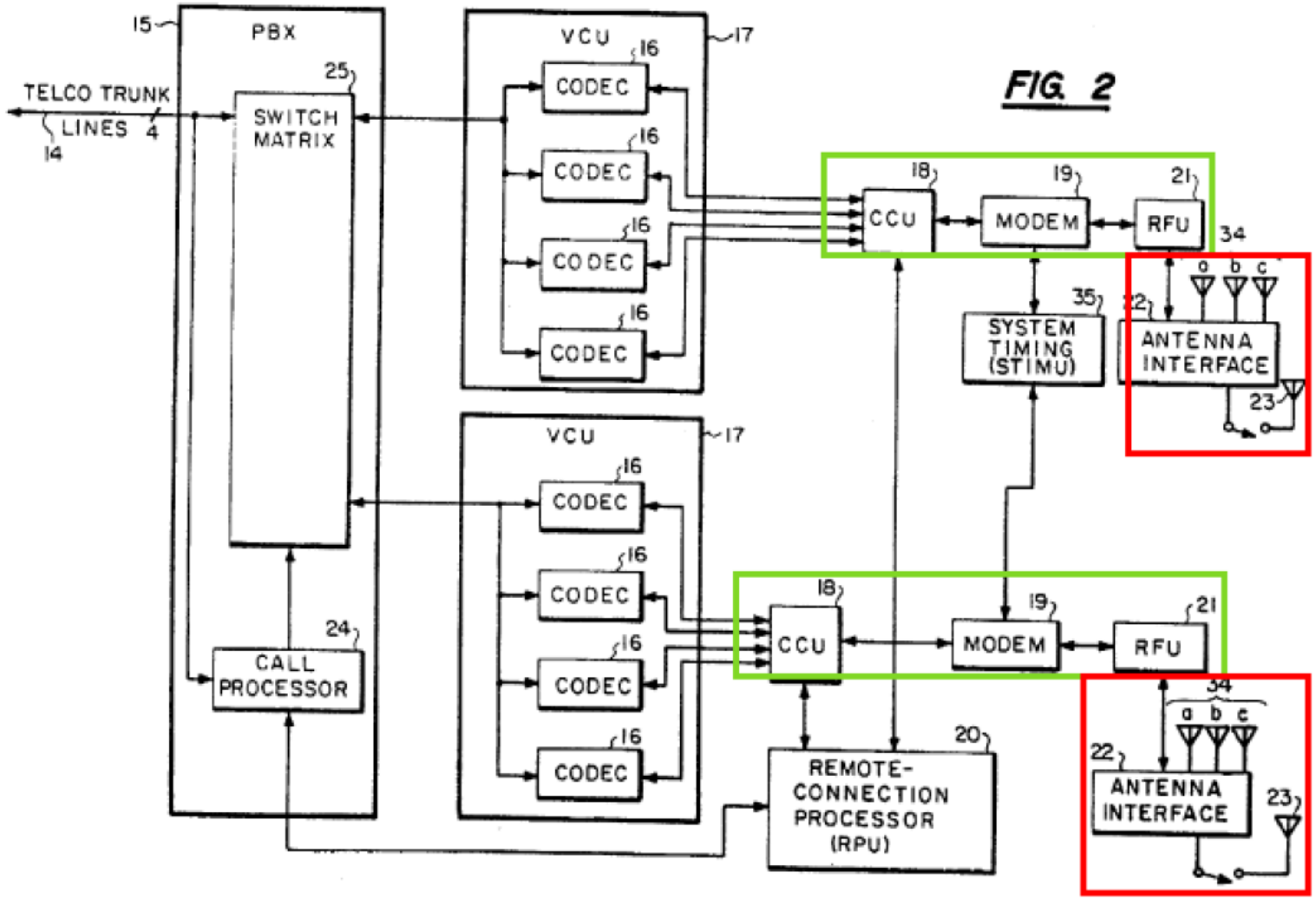
	IPR2019-01105 (’543 Patent)	Previously Addressed for the ’023 Patent?
✓	Ito Discloses the Apparatus Moving Relative to Earth and Base Station Radio Interface Circuits (*See* Slides 8, 10; ’543 Pet., Paper 2, p. 33-38)	✓
✓	Ito Discloses a Receiver Configured to Receive a Plurality of Cellular Signals (*See* Slides 9-10; ’543 Pet., Paper 2, p. 38-47)	✓
✓	Ito Discloses a Transmitter Configured to Transmit a Radio Frequency Signal Including Data from the Cellular Signals (*See* Slide 13; ’543 Pet., Paper 2, p. 47-51)	✓
✓	Paneth Discloses a Plurality of Spatially Separated Antennas	X
✓	Ito Discloses a Second Receiver and Second Transmitter	X

’543 POR, Paper 16, iii.

Petitioner’s Demonstrative Exhibit
Not Evidence

Paneth Discloses a Base Station Having a Plurality of Spatially Separated Antennas

✓ Paneth Discloses a Plurality of Spatially Separated Antennas



EX1005, Paneth, FIG. 2 (annotated); Pet. 21.

'543 Pet., Paper 2, pp. 20-23, 29-38.

Ito + Paneth Disclose Communications Using a Plurality of Spatially Separated Antennas

Exemplary Combination of Ito with Paneth's Spatially Separated Antennas

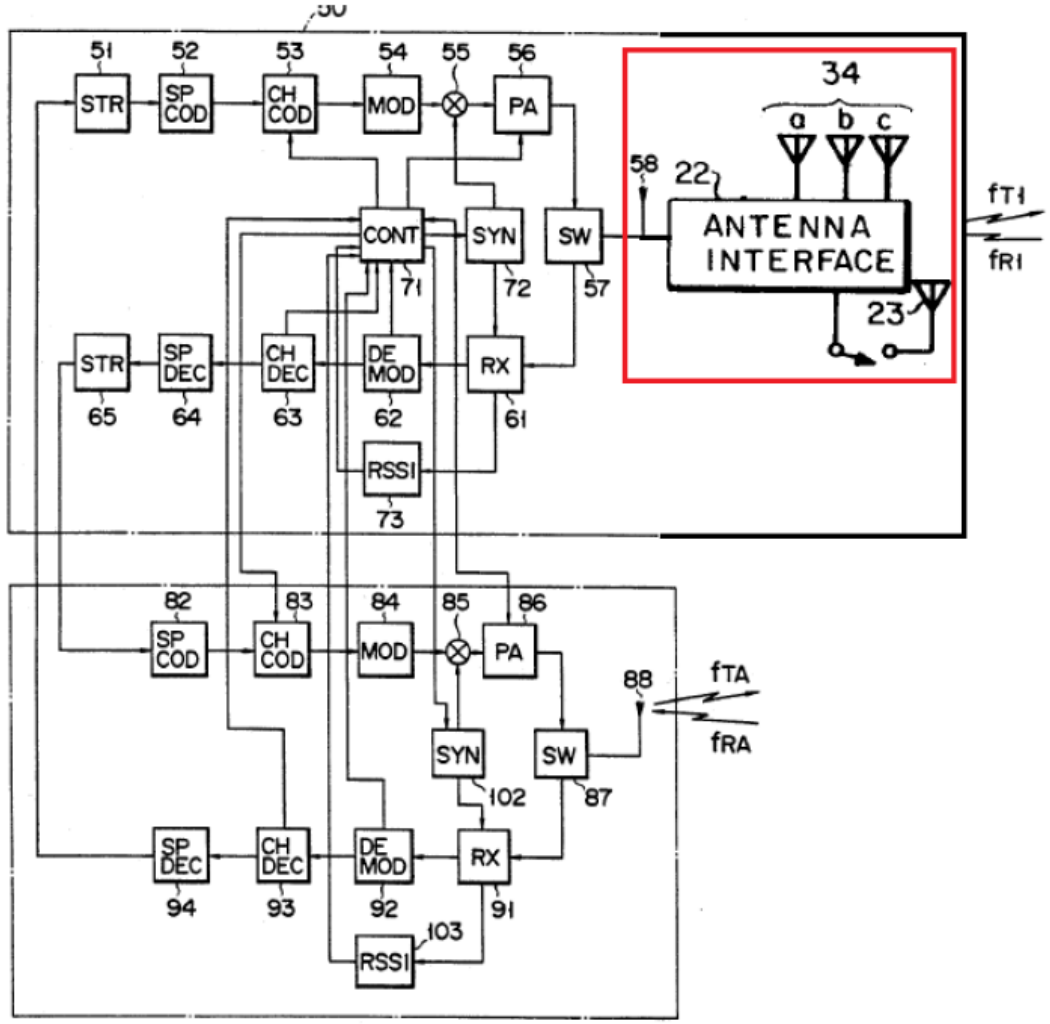


FIG. 3

EX1004, Ito, FIG. 3; EX1005, Paneth, FIG. 2 (annotated); Pet. 31.

✓ Ito and Paneth Disclose Communications Using a Plurality of Spatially Separated Antennas

'543 Pet., Paper 2, pp. 29-38.

’543 Patent – All Elements of Clams 10 & 44 Disclosed or Obvious

’543 Patent – Claim 10
10. An apparatus comprising:
a plurality of spatially separated antennas;
a receiver configured to receive, through the plurality of spatially separated antennas, a plurality of cellular signals from a plurality of base station interface circuits; and
a transmitter configured to transmit a mobile device radio frequency signal to a mobile device moving relative to Earth while the apparatus is moving relative to the plurality of base station radio interface circuits and relative to Earth, the mobile device radio frequency signal including data extracted from the cellular signals.

’543 Patent – Claim 21
21. An apparatus comprising:
a plurality of spatially separated antennas;
a first receiver configured to receive, through the plurality of spatially separated antennas, a cellular signal transmitted from a base station radio interface circuit;
a first transmitter configured to transmit a mobile device signal to a mobile device moving relative to Earth while the apparatus is moving relative to the base station radio interface circuit and in the same direction as the mobile device, the mobile device signal including data extracted from the cellular signal;
a second receiver configured to receive another mobile device signal transmitted from the mobile device; and
a second transmitter configured to transmit, using at least one of the plurality of spatially separated antennas, another cellular signal to the base station radio interface circuit while the apparatus is moving relative to the base station radio interface circuit and relative to Earth, the another cellular signal including other data extracted from the another mobile device signal.

- **Claim 44 mirrors Claim 10**
- **Claim 52 mirrors Claim 21**

’543 Pet., Paper 2, pp. 33-67.

Ito's MSS Discloses the "Second Receiver" and the "Second Transmitter"

Ito's "first transmitter-receiver unit 50" discloses the claimed "second transmitter"

Ito's "second transmitter-receiver unit 80" discloses the claimed "second receiver"

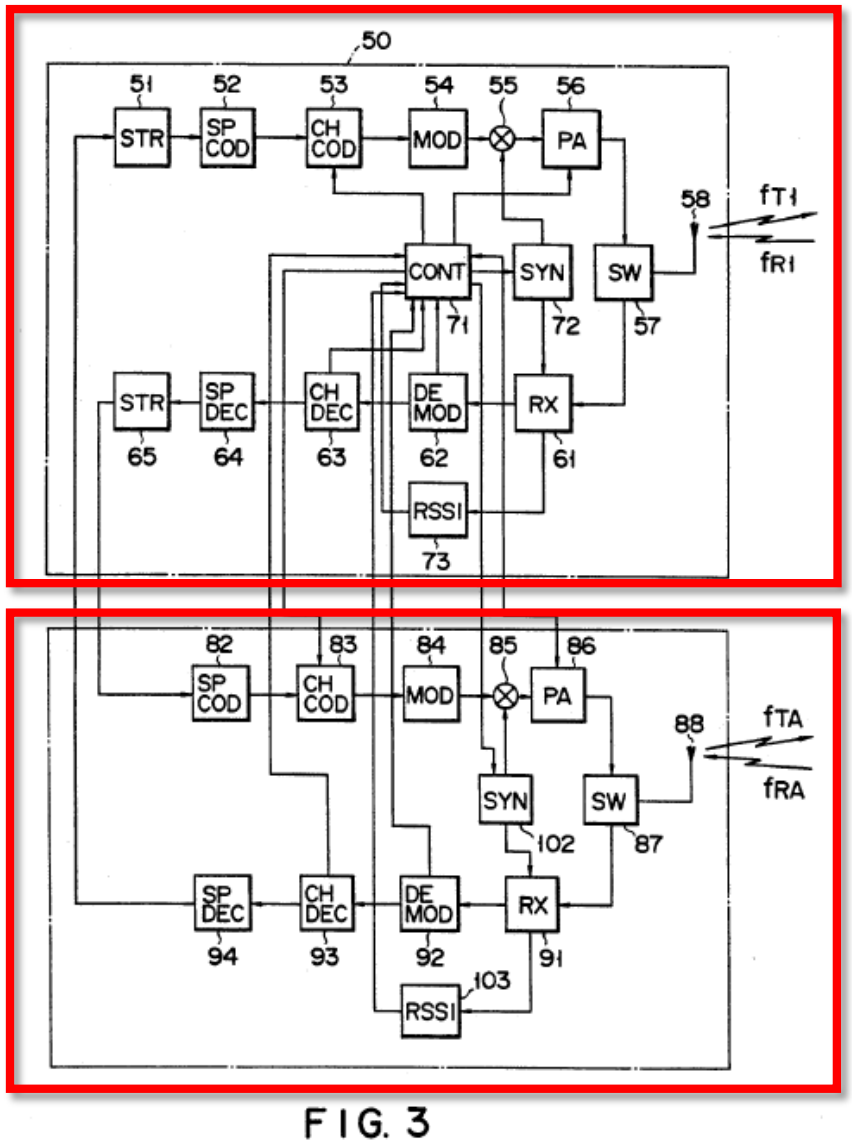


FIG. 3

'543 Pet., Paper 2, pp. 55-65; EX1004, Ito, FIG. 3 (annotated).

’543 Patent – All Elements of Claims 21 & 52 Disclosed or Obvious

’543 Patent – Claim 21
21. An apparatus comprising:
a plurality of spatially separated antennas;
a first receiver configured to receive, through the plurality of spatially separated antennas, a cellular signal transmitted from a base station radio interface circuit;
a first transmitter configured to transmit a mobile device signal to a mobile device moving relative to Earth while the apparatus is moving relative to the base station radio interface circuit and in the same direction as the mobile device, the mobile device signal including data extracted from the cellular signal;
a second receiver configured to receive another mobile device signal transmitted from the mobile device; and
a second transmitter configured to transmit, using at least one of the plurality of spatially separated antennas, another cellular signal to the base station radio interface circuit while the apparatus is moving relative to the base station radio interface circuit and relative to Earth, the another cellular signal including other data extracted from the another mobile device signal.

- **Claim 52 mirrors Claim 21**

’543 Pet., Paper 2, pp. 51-67.

Disputed Issues

I. Claim Construction
   A. Mobile Device (*See* slides 18-22)

II. Ito + Paneth
   A. Ito discloses a "mobile device" (*See* slides 28-31)

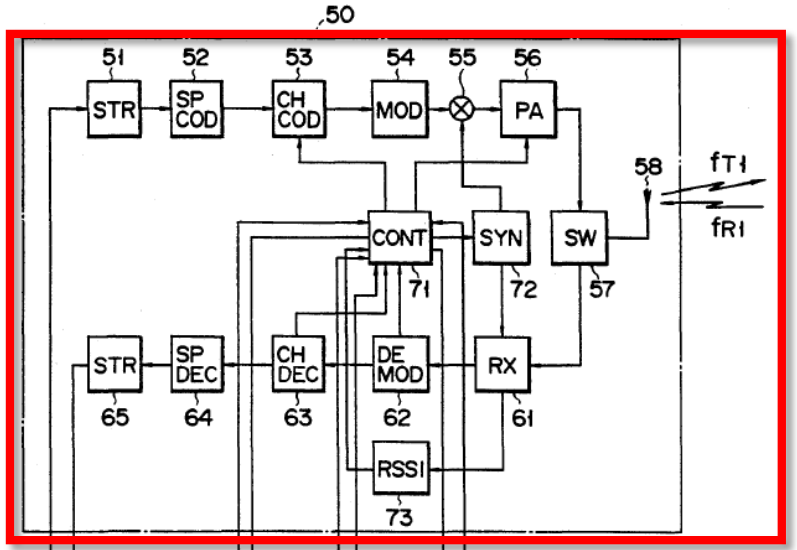
III. Motivation to Combine
   A. Ito + Paneth
   B. Ito + Paneth + Gilhousen390
   C. Ito + Paneth + Gardner

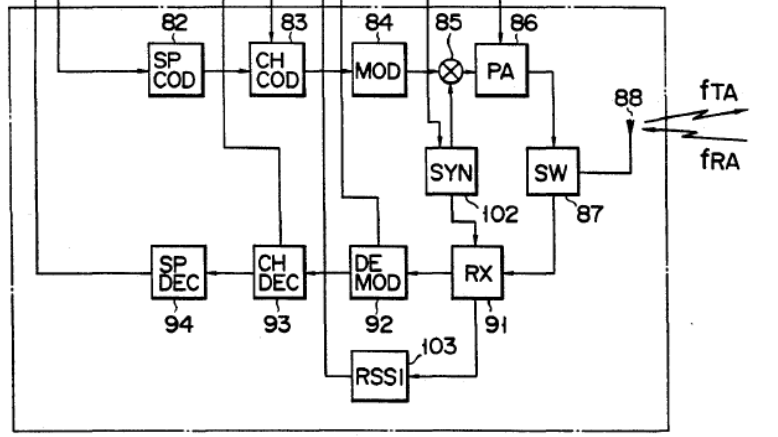
'543 Pet. Reply, Paper 19, p. i; '543 Sur-Reply, Paper 22, p. ii.

Disputed Issues – Motivation to Combine Ito + Paneth

Ito's MSS is similar to Paneth's receiver

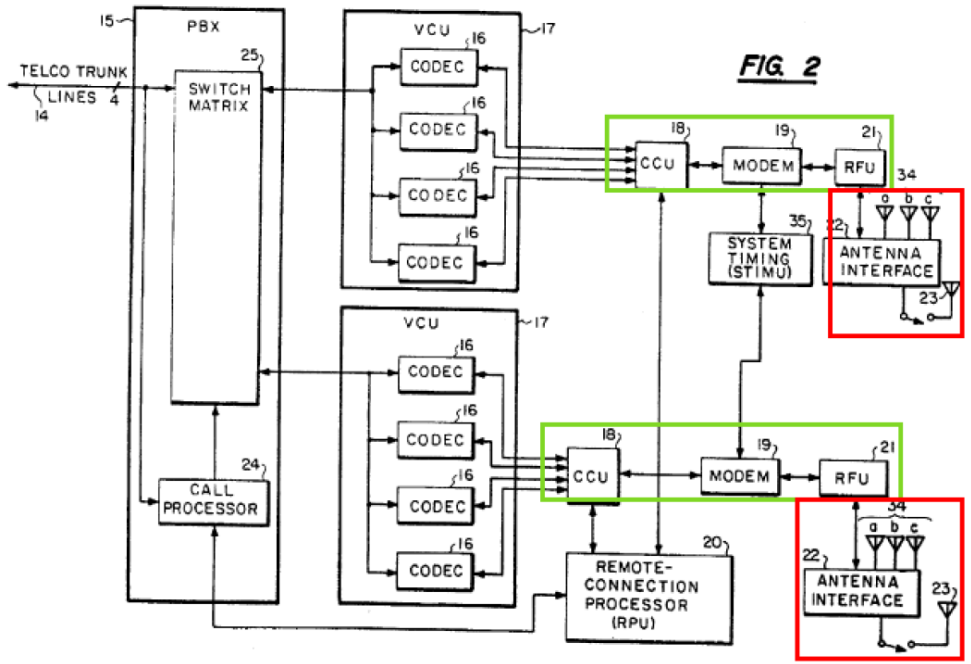
Ito's MSS Receiver





F I G. 3

Paneth's Receiver



'543 Pet., Paper 2, pp. 29-32, 38-47; EX1005, Paneth, FIG. 2 (annotated); EX1004, Ito, FIG. 3 (annotated).

Disputed Issues – Motivation to Combine Ito + Paneth

Ito acknowledges the problem of "high speed fading phenomena."

signals from diverse directions. Section VII.E. In view of this understanding and in view of Ito's disclosed goal of reducing the effects of fading—e.g., disclosing that signals transmitted to a moving device often have higher error rates due to "high speed fading phenomena," Ito, 16:49-61—a POSITA would have looked to the prior art, such as Paneth, for determining how to combat the deleterious effects of fading incumbent on signals transmitted to a moving device. Section VII.E.

EX1002, Ding Decl., ¶106; '543 Pet., Paper 2, p. 29.

Petitioner's Demonstrative Exhibit
Not Evidence

Disputed Issues – Motivation to Combine Ito + Paneth

Paneth discloses solution to the problem of fading: spatial diverse antennas

107. Paneth describes the use of a plurality of spatially diverse antennas. Paneth explains that its "system is provided with spatial diversity by using a plurality of antennas selectively spaced from each other to provide relatively high signal reception despite signal fading." Paneth, Abstract, 1:33-36. "Receive[r] diversity is provided by multiple receive antennas and multiple modems." *Id.*, 71:34-36. Paneth explains that "[t]he diversity system is capable of adding three branch diversity over the subscriber to base and the base to subscriber paths." *Id.*, 71:66-68.

Ding Decl., EX1002, ¶107; '543 Pet., Paper 2, pp. 29-30.

Petitioner's Demonstrative Exhibit
Not Evidence

Disputed Issues – Motivation to Combine Ito + Paneth

Carucel's Expert's Admission

benefits of using spatially separated antennas in moving vehicles. Indeed, PO's expert Mr. Lanning even explained multipath fading was a well-known and obvious problem affecting communications with vehicles and that many companies were working on solutions to rectify these issues:

> A: *Those were important issues that were being worked on by many different companies that spent a lot of money on trying to develop the type of receivers that could be more reliable in CDMA networks in the 1995 time frame.*

See EX1032, 262:18-22; *see also* EX1026, ¶¶38-39 (describing Calhoun's teachings of implementing spatially diverse antennas in a moving vehicle).

'543 Pet. Reply, Paper 19, pp. 16-17.

Disputed Issues – Motivation to Combine Ito + Paneth

Exemplary combination of Ito and Paneth

While this figure depicts the antenna configuration, the Petition also explains that "the *conventional signal processing circuitry described in Paneth* could also be combined with the mobile base device MSS or the mobile base device MSS circuitry could be configured to support communication through the plurality of spatially separated antennas." Pet., 32. As Dr. Ding explained in his original declaration, an example of this circuitry would include Paneth's "diversity combiner" circuitry, which would support communication through the plurality of spatially separated antennas. EX1002, ¶111; EX1026, ¶¶43-44. As previously explained, a POSA would have easily combined Paneth's antennas, circuitry, and signal processing techniques with Ito in view of the overlapping and common circuitry utilized by both systems. Pet., 32; EX1002, ¶112.

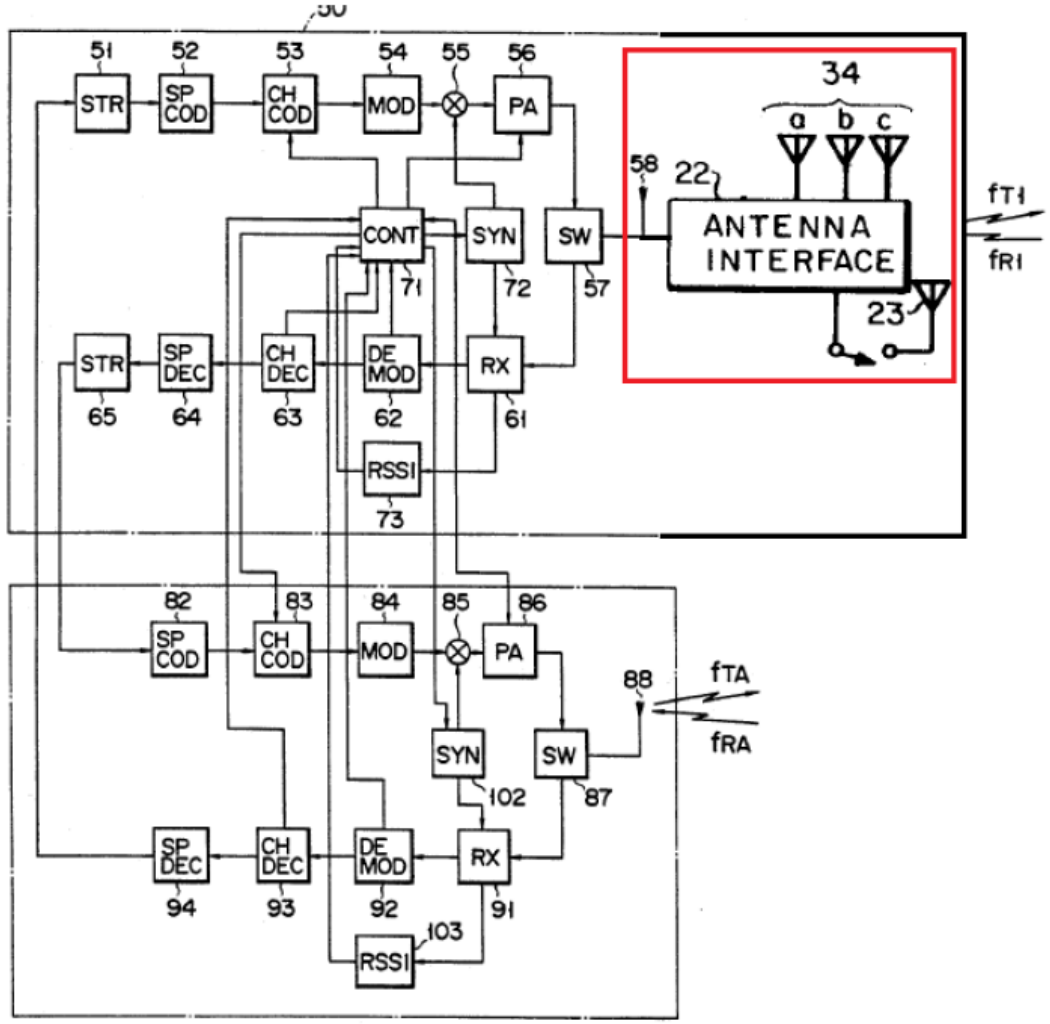


FIG. 3

EX1004, Ito, FIG. 3; EX1005, Paneth, FIG. 2 (annotated); Pet. 31.

'543 Pet., Paper 2, pp. 29-38; Pet. Reply, pp. 18-19.

Petitioner's Demonstrative Exhibit
Not Evidence

Disputed Issues – Motivation to Combine Ito + Paneth + Gilhousen390

It would have been obvious for the signals received by Ito's MSS from the BSS to be CDMA signals

A POSITA would have been motivated to incorporate the CDMA communication protocol into the mobile base device MSS to aid in increasing spectral efficiency. Ding, ¶180. For example, Gilhousen explains that "[a]lthough other techniques such as time division multiple access (TDMA), frequency division multiple access (FDMA) and AM modulation schemes such as amplitude companded single sideband (ACSSB) are known, CDMA has significant advantages over these other techniques." Gilhousen, 1:17-22. "In using CDMA communications, the frequency spectrum can be reused multiple times thus permitting an increase in system user capacity. The use of CDMA results in a much higher spectral efficiency than can be achieved using other multiple access techniques." *Id.*, 1:37-42. Paneth also recites that it is desirable to increase spectral

'543 Pet., Paper 2, p. 76.

Petitioner's Demonstrative Exhibit
Not Evidence

Disputed Issues – Motivation to Combine Ito + Paneth + Gilhousen390

Carucel argues FDMA/TDMA is incompatible with CDMA

interfaces use different technology.[7] As explained by Mr. Lanning, "these compatibility issues prohibit *Ito's* pre-existing base stations (BSS) from transmitting CDMA signals and further prohibit *Ito's* mobile base stations (MSS) from receiving CDMA signals, as Petitioner proposes." Lanning Decl. ¶137. Critically, neither the Petition nor Dr. Ding's Declaration even acknowledge any compatibility issues that would arise when trying to implement *Gilhousen390's* CDMA functionality into either the pre-existing base stations (BSS) or the mobile base unit (MSS) of *Ito* that are designed for a FDMA/TDMA system, much less offer any explanation as to how to resolve these compatibility issues, or whether there is a reasonable expectation of success in light of these compatibility issues. Instead, the Petitioner attempts to

'543 POR, Paper 16, pp. 24-25.

FDMA/TDMA is compatible with CDMA for the same reasons discussed for the '023 patent.

See Slides 51-53; Ding Reply Decl., EX1026, ¶¶49-61; '543 Pet. Reply, Paper 19, pp. 20-24.

Petitioner's Demonstrative Exhibit
Not Evidence

Disputed Issues – Motivation to Combine Ito + Paneth + Gardner

Carucel's Argument

As an initial matter, Petitioner's contention that "PO has not provided any rationale indicating why a POSA would not have combined these references"[14] is simply unfounded. Contrary to Petitioner's assertion, Patent Owner set forth various reasons why a POSITA would not have been motivated to combine *Ito* and *Paneth* with *Gardner*. *See* POR at 35. For example, Patent Owner provides that a "POSITA would not have been motivated to combine *Ito* and *Paneth* with *Gardner* because *Gardner* does not provide any guidance on how its device can be used for the different types of cellular networks (i.e., CDMA, FDMA or TDMA)." *Id*. As Mr. Lanning explained "[w]ithout this guidance, a POSITA would need to design and try multiple implementations and significant experimentation to make Gardner operate for any of these MA methods." Ex. 2100, ¶142. Therefore, a POSITA would

'543 PO Sur-Reply, Paper 22, p. 17.

VW's Reply

PO does not argue that combining Ito, Paneth, and Gardner would result in an inoperable system or that a POSA would be discouraged from forming this combination. As acknowledged by Mr. Lanning, a POSA would simply need to be careful when combining these teachings. *See* EX1032, 272:11-273:7. In this manner, PO has not provided any rationale indicating why a POSA would not have combined these references. Thus, PO does not rebut the explicit rationale provided in the Petition explaining why a POSA would have been motivated to combine Gardner with Ito and Paneth. *See* Pet., 77-81; EX1026, ¶¶62-64.

'543 Pet. Reply, Paper 19, pp. 24-25.

'543 Pet., Paper 2, pp. 77-81.

IPR2019-01101
’904 Patent

Instituted Grounds

IPR2019-01101 (’904 Patent)		
	Claim(s)	References
Ground 1	22, 23, 28-35, 40, 50, and 51	Gilhousen865 (EX1005) and Gilhousen390 (EX1006)
Ground 2	22, 23, 28, 29, 32-35, 40, 50, 51	Vercauteren (EX1007) and Forssén (EX1008)
Ground 3	30, 31	Vercauteren, Forssén, and Gilhousen390
Ground 4	56	Gilhousen865
Ground 5	57-59	Gilhousen865 and Gilhousen390
Ground 6	56	Vercauteren
Ground 7	57, 58	Vercauteren and Gilhousen390
Ground 8	59	Vercauteren, Gilhousen390, and Forssén

***Grounds 4-8 were originally numbered Grounds 1-5 in IPR2019-01573**

’904 First Pet., pp. 5-6; ’904 First DI., p. 20; ’904 Second Pet., p. 6; ’904 Second DI., p. 20.

Petitioner’s Demonstrative Exhibit
Not Evidence

’023 Patent vs. ’904 Patent

IPR2019-01103 (’023 Patent) – Claim 11
11. An apparatus configured to move relative to Earth, the apparatus comprising:
a plurality of spatially separated antennas; and
a receiver configured to receive fixed port signals from a fixed port through the plurality of spatially separated antennas; and
a transmitter configured to transmit radio frequency signals to a mobile device corresponding to the received fixed port signals.

IPR2019-01101 (’904 Patent) – Claim 22
22. An apparatus adapted to move in accordance with a movement of a mobile unit moving relative to a plurality of fixed radio ports, the apparatus comprising:
a receiver adapted to receive a plurality of signals, each of the plurality of signals transmitted from each of the plurality of fixed radio ports within a frequency band having a lower limit greater than 300 megahertz;
a transmitter adapted to transmit, within the frequency band, a resultant signal to the mobile unit in accordance with at least one of the plurality of signals; and
a processor adapted to maximize an amount of transferred information to the mobile unit by evaluating a quality of each of the plurality of signals transmitted from the plurality of fixed radio ports.

’904 Patent – Independent Claims 22, 34, and 50

’904 Patent – Claim 22
22. An apparatus adapted to move in accordance with a movement of a mobile unit moving relative to a plurality of fixed radio ports, the apparatus comprising:
a receiver adapted to receive a plurality of signals, each of the plurality of signals transmitted from each of the plurality of fixed radio ports within a frequency band having a lower limit greater than 300 megahertz;
a transmitter adapted to transmit, within the frequency band, a resultant signal to the mobile unit in accordance with at least one of the plurality of signals; and
a processor adapted to maximize an amount of transferred information to the mobile unit by evaluating a quality of each of the plurality of signals transmitted from the plurality of fixed radio ports.

’904 Patent – Claim 34
34. An apparatus adapted to move in accordance with a movement of a plurality of mobile units moving relative to a plurality of fixed radio ports at a velocity greater than a relative velocity of movement between each of the mobile units of the plurality of mobile units, the apparatus comprising:
a first radio interface adapted to communicate with the plurality of fixed radio ports in a frequency band;
a second radio interface adapted to communicate with the plurality of mobile units in the frequency bandwidth, the frequency having a lower limit greater than 300 megahertz; and
a processor adapted to establish a communication link between the plurality of mobile units and at least one of the plurality of fixed radio ports based on a plurality of signal quality indicators, each of the signal quality indicators corresponding to each of a plurality of transmitted signals transmitted from the plurality of fixed radio ports.

’904 Patent – Claim 50
50. A method of providing a communication link between a communication network and a mobile unit having a motion relative to a plurality of fixed ports, wherein the plurality of fixed ports are communicatively coupled to the communication network, the method comprising the steps of:
moving a movable base station in accordance with the motion of the mobile unit;
receiving a plurality of signals at the movable base station, each of the plurality of signals transmitted from each of the plurality of fixed radio ports within a frequency band having a lower limit greater than 300 megahertz;
transmitting, within the frequency band, a resultant signal to the mobile unit in accordance with at least one of the plurality of signals; and
maximizing an amount of transferred information to the mobile unit by evaluating a quality of each of the plurality of signals transmitted from the plurality of fixed radio ports.

Independent claims 22, 34, and 50 recite similar claim elements

’904 patent, Claims 22, 34, 50; ’904 First Pet., Appendix A.

Petitioner’s Demonstrative Exhibit
Not Evidence

’904 Patent – Independent Claim 56

’904 Patent – Claim 56
56. A method of providing a communication connection between a communication network and a plurality of mobile units having a motion relative to a plurality of fixed ports, wherein the plurality of fixed ports are communicatively coupled to the communication network, the method comprising the steps of:
establishing a first communication link between the plurality of mobile units and a first fixed port of the plurality of fixed ports through a movable base station having a motion in accordance with the motion of the mobile units; and
simultaneously handing off the plurality of mobile units to a second fixed port of the plurality fixed ports.

EX1001, ’904 patent, Claim 56; ’904 Second Pet., 26-37.

Undisputed Issues

	IPR2019-01101 (’904 Patent)	Previously Addressed for the ’023 Patent?
✓	Gilhousen865 + Gilhousen390 Discloses a Receiver Adapted to Receive a Plurality of Signals from a Plurality of Fixed Radio Ports (*See* Slide 15; ’904 First Pet., p. 34-38)	✓
✓	Gilhousen865 + Gilhousen390 Discloses a Transmitter Adapted to Transmit a Signal to the Mobile Unit (*See* Slide 16; ’904 First Pet., p. 38-40)	✓
✓	Gilhousen865 + Gilhousen390 Discloses a Processor Adapted to Maximize an Amount of Transferred Information to the Mobile Unit	X
✓	Vercauteren + Forssén Discloses an Apparatus Adapted to Move in Accordance with a Movement of a Mobile Unit Moving Relative to a Plurality of Fixed Radio Ports	X
✓	Vercauteren + Forssén Discloses a Transmitter Adapted to Transmit a Signal to the Mobile Unit	X

’904 POR, Paper 16, ii-v.

Petitioner’s Demonstrative Exhibit
Not Evidence

Gilhousen865 + Gilhousen390 Discloses a Processor Adapted to Maximize an Amount of Transferred Information to the Mobile Unit

Gilhousen390

Receiver **44** will measure the strength of any reception of a desired waveform at times other than the nominal time. Receiver **44** compares signal strength in the received signals. Receiver **44** provides a signal strength signal to control processor **46** indicative of the strongest signals and relative time relationship.

Processor **46** provides signals to control digital data receivers **40** and **42** for each to process a different one of the strongest signals. On occasion another cell-site transmitted pilot signal is of greater signal strength than the current cell-site signal strength. Control processor **46** then would generate a control message for transmission to the system controller via the current cell-site requesting a transfer of the call to the cell-site corresponding to the stronger pilot signal. Receivers **40** and **42** may therefor handle calls through two different cell-sites.

The outputs of receivers **40** and **42** are provided to diversity combiner and decoder circuitry **48**. The diversity combiner circuitry contained within circuitry **48** simply adjusts the timing of the two streams of received signals into alignment and adds them together. This addition process may be proceeded by multiplying the two streams by a number corresponding to the relative signal strengths of the two streams. This operation can be considered a maximal ratio diversity combiner. The resulting combined signal stream is then decoded using a forward stream error detection decoder also contained within circuitry **48**.

Gilhousen865 + Gilhousen390 Discloses a Processor Adapted to Maximize an Amount of Transferred Information to the Mobile Unit

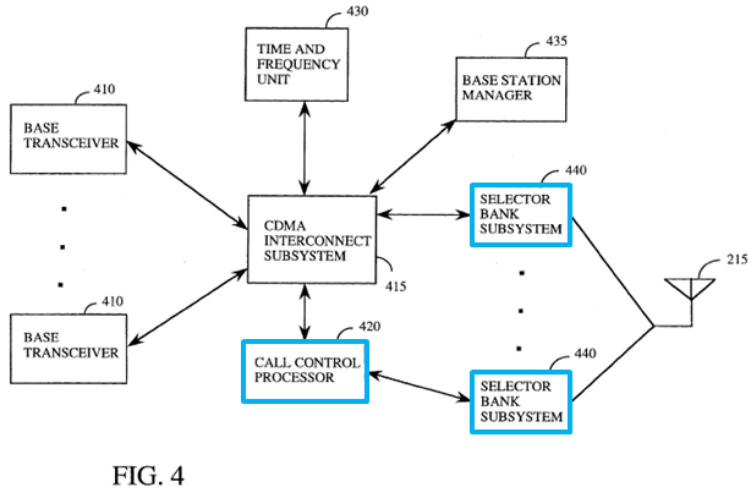


FIG. 4

Gilhousen865, FIG. 4 (annotated).

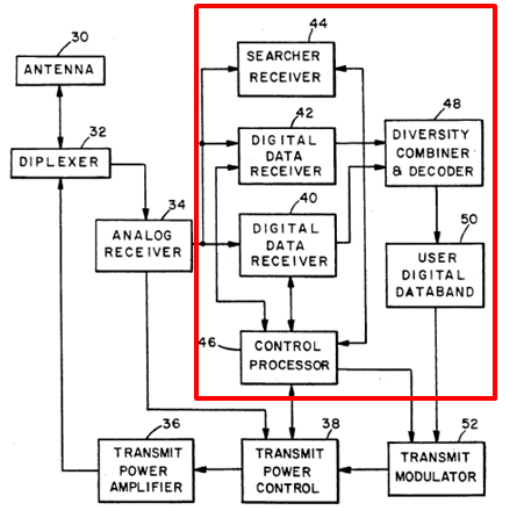


FIG. 2

Gilhousen390, FIG. 2 (annotated).

'904 First Pet., pp. 40-45.

Gilhousen390, 13:4-32.

Vercauteren + Forssén Discloses an Apparatus Adapted to Move in Accordance with a Movement of a Mobile Unit Moving Relative to a Plurality of Fixed Radio Ports

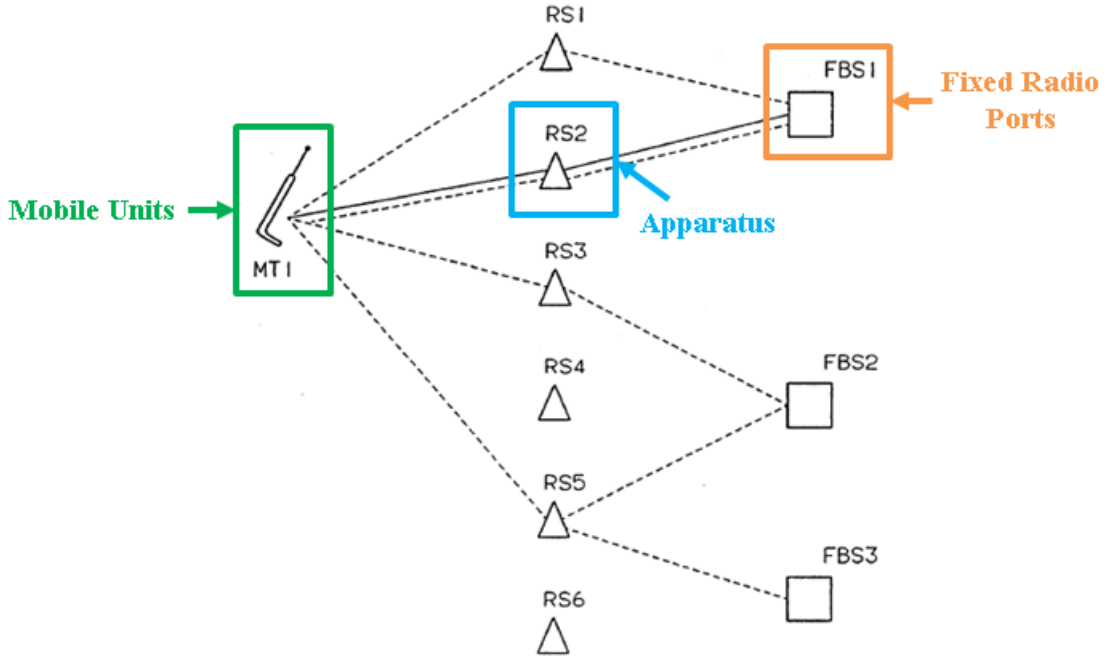
Vercauteren + Forssén Discloses an Apparatus Adapted to Move in Accordance with a Movement of a Mobile Unit Moving Relative to a Plurality of Fixed Radio Ports

Vercauteren

A third important class of environments is covered by the relay stations RRS coupled to the fixed level FL through 'mobile' radio links MTGCRN. Such roaming relay stations RRS can be used to cover for instance public transport media or more generally any transport medium carrying a plurality of mobile terminal users. To fix ideas, one such transport medium, a train, is hereafter described in further detail.

The terrestrial mobile radio network TMRN adapted to serve hand-held terminals TMT, DMT would provide an unviable solution if these terminals were situated on the train and had to communicate directly with fixed relay stations FFRS or fixed base stations FBS. However, through its generic structure, the present mobile network MCN allows the traffic of these latter mobile terminals to be concentrated via a high power roaming relay station RRS mounted on the train and coupled to the fixed level FL via a specific type of relay link. In the present case the latter link has to be a mobile radio link within MTGCRN.

Vercauteren, 16:47-64.



Vercauteren, FIG. 2 (annotated).

'904 First Pet., pp. 61-63.

Petitioner's Demonstrative Exhibit
Not Evidence

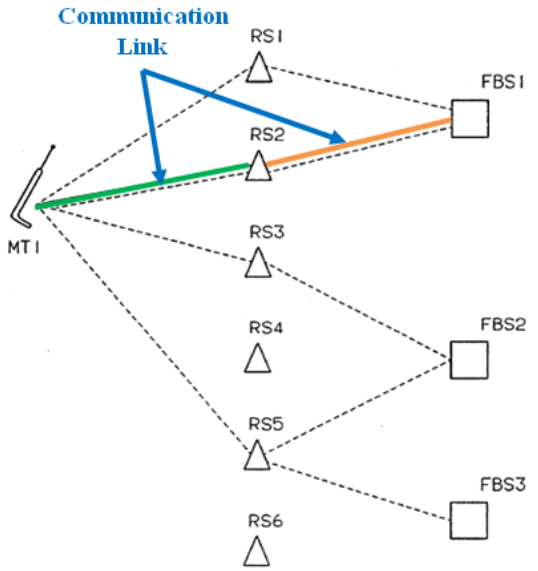
Vercauteren + Forssén Discloses a Transmitter Adapted to Transmit a Signal to the Mobile Unit

Vercauteren + Forssén Discloses a Transmitter Adapted to Transmit a Signal to the Mobile Unit

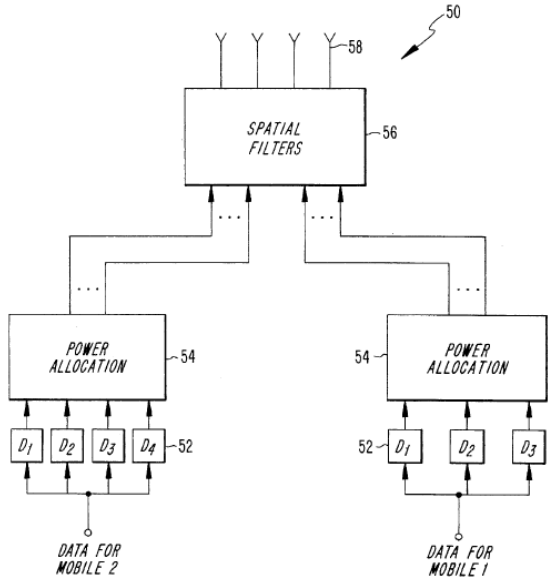
Petitioner's Expert, Dr. Ding

247. A POSITA would have understood that a transmitter such as that described in Forssén would enable the relay station of Vercauteren to "*transmit … a resultant signal to the mobile unit in accordance with at least one of the plurality of signals*." A POSITA would have further recognized that it would be beneficial

'904 First Ding Decl., ¶247.



Vercauteren, FIG. 2 (annotated).



Forssén, FIG. 3.

'904 First Pet., pp. 66-69.

Disputed Issues

I. Claim Construction
   A. Mobile Unit (*See* slides 18-22)

II. Gilhousen865 + Gilhousen390
   A. Gilhousen865 discloses a "mobile unit" (*See* slides 37-39)
   B. Gilhousen865 discloses an "apparatus adapted to move in accordance with a movement of a mobile unit" (Similar issue discussed in slides 34-36)
   C. Gilhousen865/Gilhousen390 disclose "a transmitter adapted to transmit, within the frequency band, a resultant signal to the mobile unit"
   D. Gilhousen865 discloses "simultaneously handing off the plurality of mobile units to a second fixed port of the plurality fixed ports"
   E. Gilhousen865/Gilhousen390 disclose "wherein the processor is further adapted to determine a best fixed radio port"

'904 Pet. Reply, Paper 22, pp. i-ii; '904 POR, Paper 19, pp. ii-v.

Petitioner's Demonstrative Exhibit
Not Evidence

Disputed Issues

III. Vercauteren + Forssén

A. Vercauteren discloses a “mobile unit”

B. Vercauteren/Forssén disclose an “apparatus adapted to move in accordance with a movement of a mobile unit”

C. Vercauteren/Forssén disclose a “processor adapted to … evaluat[e] a quality of each of the plurality of signals transmitted from the plurality of fixed radio ports”

D. Vercauteren discloses “simultaneously handing off the plurality of mobile units to a second fixed port of the plurality fixed ports”

IV. Motivation to Combine

A. Gilhousen865 + Gilhousen390 (*See* slides 54-58)

B. Vercauteren + Forssén

C. Vercauteren + Gilhousen390

D. Vercauteren + Gilhousen390 + Forssén

’904 Pet. Reply, Paper 22, pp. i-ii; ’904 POR, Paper 19, pp. ii-v.

Petitioner’s Demonstrative Exhibit
Not Evidence

Gilhousen865 Discloses an "apparatus adapted to move in accordance with a movement of a mobile unit"

Carucel's Argument

However, *Gilhousen865* does not disclose or imply any apparatus (i.e., a moving base station) that is constructed to move with the traffic at a rate of speed which is comparable to the speed of the traffic as required by the limitation of a "adapted to" in the context of the entire '904 Patent and as previously construed by the civil court. *See supra* Section IV.C. An airplane does not move with traffic as it is not bound to predetermined roads. *See* Lanning Decl. ¶¶174-175. Traffic or rate of speed of traffic, as used in the '904 Patent and construed by the civil court, is referring to "an automotive vehicle traveling on a roadway," not "airplane traffic" as alleged by Petitioner. (Ex. 1001, 6-10). Additionally, an airplane can travel at speeds up to five hundred miles-per-hour and, as such, does not move with the traffic at a rate of speed which is comparable to the traffic. *Id.* at ¶175. Put simply, Petitioner has failed to account for the construction of the term "adapted to" as set forth by the civil court and further supported by the '904 Patent specification—"constructed to move with the traffic at a rate of speed which is comparable to the speed of the traffic."

'904 POR, Paper 19, p. 44.

Petitioner's Demonstrative Exhibit
Not Evidence

Gilhousen865 Discloses an "apparatus adapted to move in accordance with a movement of a mobile unit"

VWGoA's Expert, Dr. Ding

is not **bound to predetermined roads**." EX2100, ¶175; *see also id.*, ¶199. First, I note that Mr. Lanning never states or provides any other support that "traffic" is limited to predetermined roads. This is actually inconsistent with the '904 specification, which discloses embodiments where the movable base station moves relative to other types of traffic, including "pedestrian traffic." *See, e.g.*, EX1001, 2:39-42 ("In the hierarchal cell structure, the low tier, small cells, e.g., on the order of 100 feet in diameter, accommodate low speeds. The low speed is mostly **pedestrian traffic and other traffic** moving at speeds below 30 miles per hour."), 3:35-39, 4:48-51.

'904 Ding Reply Decl., EX1030, ¶26.

described in the '904 patent (e.g., pedestrian traffic). The term "traffic" also had a common and well-known understanding at the time of the '904 patent. For example, dictionaries at the time defined "traffic" as "vehicles moving on a public highway, **in the air**, or at sea." EX1032, Oxford Desk Dictionary, 611. Gilhousen865's airplane certainly meets this definition. And a POSA would have understood that Gilhousen865's airplane is a vehicle moving in the air. Therefore, it is my opinion that Mr. Lanning's proposed interpretation of "traffic" is incorrect and unduly limiting.

'904 Ding Reply Decl., EX1030, ¶27.

'904 First Pet., Paper 2, pp. 32-33; '904 Pet. Reply, Paper 22, pp. 11-13.

Gilhousen865 and Gilhousen390 Disclose "a transmitter adapted to transmit, within the frequency band, a resultant signal to the mobile unit"

Carucel's Argument

Critically, as illustrated above by Patent Owner's Demonstrative Figure 2, *Gilhousen390* does not disclose or imply any apparatus (i.e., a moving base station) that comprises a transmitter "adapted to transmit, within the frequency band, a resultant signal to the mobile unit," as required by Claim 22.[16] *See* Lanning Decl. ¶¶183-187.

Accordingly, the Petition fails to show that *Gilhousen865* in view of *Gilhousen390* discloses or renders obvious this limitation required by Claim 22.

'904 POR, Paper 19, p. 49.

VWGoA's Expert, Dr. Ding

limitation of Claim 22." EX2100, ¶186. But Mr. Lanning does not consider the *combination* of Gilhousen865 and Gilhousen390. Rather, Mr. Lanning incorrectly asserts that I rely on Gilhousen390 alone for this element, when in fact I rely on Gilhousen390 merely for its techniques of receiving and combining multiple signals within a similar CDMA wireless communication system. EX1003, ¶¶137-41. My analysis applies these techniques and disclosure to Gilhousen865's airborne communication system, which provides the "moving base station." *Id.*

'904 Ding Reply Decl., EX1030, ¶31.

'904 First Pet., Paper 2, pp. 38-40; '904 Pet. Reply, Paper 22, pp. 13-14; '904 POR, Paper 19, p. 49.

The Combination of Gilhousen865 and Gilhouses390 Discloses the Elements of Independent Claims 22, 34, and 50

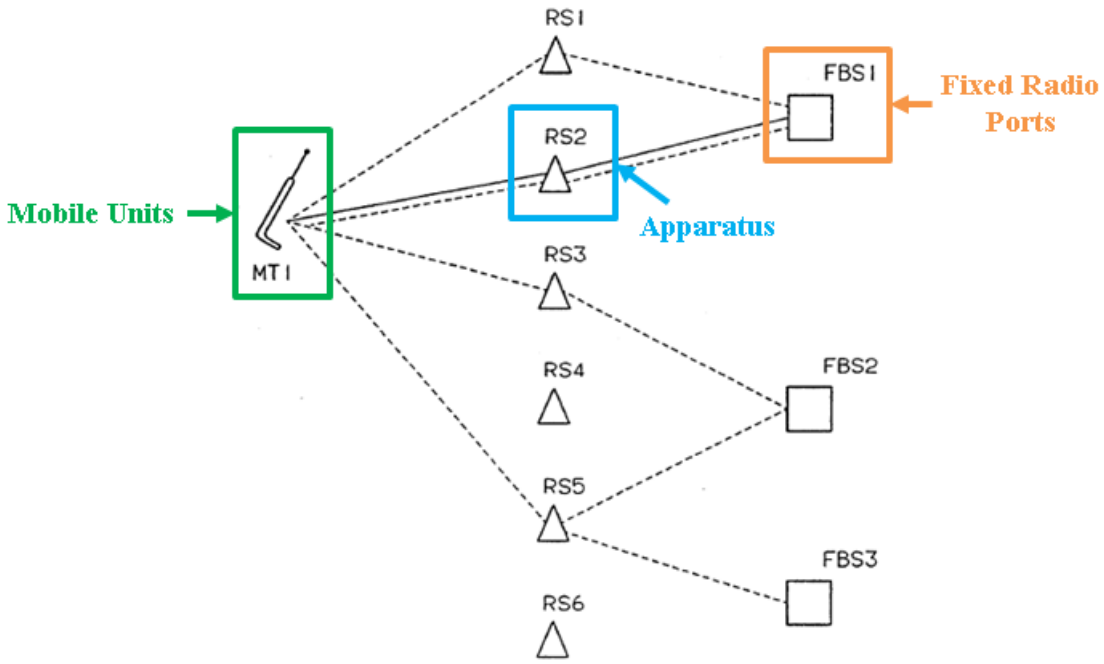
’904 Patent – Claim 22	
22. An apparatus adapted to move in accordance with a movement of a mobile unit moving relative to a plurality of fixed radio ports, the apparatus comprising:	’904 First Pet., p. 31-34.
a receiver adapted to receive a plurality of signals, each of the plurality of signals transmitted from each of the plurality of fixed radio ports within a frequency band having a lower limit greater than 300 megahertz;	’904 First Pet., p. 34-38.
a transmitter adapted to transmit, within the frequency band, a resultant signal to the mobile unit in accordance with at least one of the plurality of signals; and	’904 First Pet., p. 38-40.
a processor adapted to maximize an amount of transferred information to the mobile unit by evaluating a quality of each of the plurality of signals transmitted from the plurality of fixed radio ports.	’904 First Pet., p. 40-45.

’904 First Pet., Paper 2, pp. 31-45.

Petitioner’s Demonstrative Exhibit
Not Evidence

Vercauteren Discloses “a mobile unit”

Vercauteren Discloses the Plain and Ordinary Meaning of “mobile device,” as well as VWGoA’s alternative construction



Vercauteren, EX1007, FIG. 2 (annotated).

VWGoA’s Expert, Dr. Ding

231. Vercauteren discloses that “[t]he relay network RN contains at least two types of relay links, fixed links known as the global coverage fixed network GCFN and radio links known as the global coverage radio network GCRN.” *Id.*, 8:44-49. Vercauteren discloses that a relay station “corresponding to the global coverage radio network GCRN may be used as a relay station mounted on a train [].” *Id.*, 8:54-58. A “relay link, i.e. a ‘mobile’ radio link within the global coverage radio network GCRN [] may be chosen so as to couple the relay station RS to at least one fixed base station FBS.” *Id.*, 8:58-64. Thus, the relay stations mounted on the train are the roaming relay stations. “Such roaming relay stations RRS can be used to cover for instance public transport media or more generally any transport medium carrying a plurality of mobile terminal users.” *Id.*, 16:48-51. Vercauteren contemplates a train with roaming relay stations RRS mounted on it as a transport medium carrying a plurality of mobile terminal users. *Id.*, 16:51-52.

’904 First Ding Decl., EX1003, ¶231.

’904 First Pet., Paper 2, pp. 61-63; ’904 Pet. Reply, Paper 22, pp. 20-23.

Vercauteren Discloses “a mobile unit”

Carucel’s Argument

protocols for communication. *Id*. Moreover, *Vercauteren* does not disclose, teach or suggested any ability of its Mobile Terminals to communicate with any “moving base stations” in the context of the ’904 Patent. *Id.* Instead, the only moving apparatus in *Vercauteren* that is capable of communicating with the Mobile Terminals are the Roaming Relay Station (RRS). However, as previously discussed, the Roaming Relay Stations are purposely: (i) limited to “minimum intelligence”; (ii) lack “mobile intelligence”; and (iii) do not contain any type of base station functionality due to complexity and economic reasons. *See supra* Section X.B. Likewise, *Vercauteren* does not disclose, teach or suggested any ability of its mobile unit to register with a cellular network. *See* Lanning Decl. ¶245.

’904 POR, Paper 19, p. 68.

Vercauteren Discloses “a mobile unit”

Vercauteren Discloses “mobile device” even under PO’s proposal

First, the Petitions explain that Vercauteren’s roaming relay stations provide the claimed “apparatus,” e.g., “moving base station,” because it facilitates communication between the mobile terminals and fixed base stations and is mounted on a moving train. 1101 Pet., 61-63; EX1030, ¶52. The Petition also provides reasons for implementing certain traditional “base station” logic in Vercauteren’s roaming relay station, as suggested by Vercauteren’s desire to remove “the signalling [*sic*] load associated to the hand-over protocol … from the fixed network.” Pet., 71 (citing EX1007, 4:65-5:2). PO does not dispute that this would allow Vercauteren’s mobile terminals to communicate with a “moving base station”; rather, PO merely relies on its motivation to combine arguments, which

’904 Pet. Reply, Paper 22, p. 21.

Indeed, Vercauteren discloses that its “present invention relates to a mobile communication network adapted to set up communication paths between any one of a plurality of mobile terminals and a fixed telecommunication network,” and “[s]uch a mobile communication network is already known in the art, e.g. from the pan-European **digital cellular GSM network**.” EX1007, 1:8-11, 1:25-27; *see also id.*, 15:31-36 (“A first class of environments for these mobile terminals TMT, DMT is covered by fixed relay stations FFRS associated with fixed relay links GCFN. This first class includes particularly the ‘conventional’ hand-held cellular applications which are already supported by the known GSM-network.”). Moreover, Vercauteren discloses that its “roaming **mobile terminals UT can be coupled to the fixed base stations FBS** of the fixed level FL either **directly** by way of a direct coverage mobile radio network DCMRN or indirectly via an indirect coverage mobile radio network ICMRN.” EX1007, 7:55-59. Thus, there is no dispute that Vercauteren’s mobile terminals have traditional cellular capabilities and can communicate directly with the fixed base stations. EX1030, ¶¶53-56. And because these mobile terminals function as traditional cellular devices, a POSA would have understood these devices would register with the cellular network as part of Vercauteren’s hand-over processes. *See, e.g.*, EX1007, 10:6-14; EX1030,

’904 Pet. Reply, Paper 22, pp. 22-23.

Petitioner’s Demonstrative Exhibit
Not Evidence

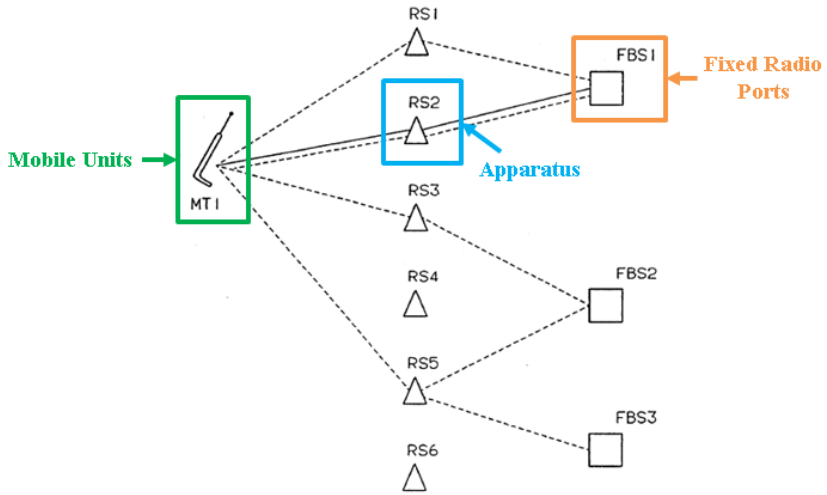
Vercauteren and Forssén Disclose a "receiver adapted to receive a plurality of signals … transmitted from each of the plurality of fixed radio ports"

Patent Owner does not dispute that Forssén's receiver receives a plurality of signals

Carucel's Expert

Instead, Forssén is disclosing multiple versions of the same signals that are being transmitted from a single base station or a single radio port.

EX1035, Lanning Dep., 179:12-15.



Vercauteren, FIG. 2 (annotated).

VWGoA's Expert, Dr. Ding

Thus, Mr. Lanning only challenges where the signals originate from in Forssén, but he does not appear to dispute that Forssén discloses receiving a "plurality of signals." *Id.*, 180:4-5 ("Multiple versions of the same signal is a plurality of signals."). But within the context of Vercauteren's roaming relay station mounted on a train, the combination of Vercauteren and Forssén teaches "a receiver adapted to receive a plurality of signals … transmitted from each of the plurality of fixed radio ports" because Vercauteren teaches receiving a plurality of signals from multiple fixed base stations, as I noted above.

'904 Ding Reply Decl., EX1030, ¶59.

'904 First Pet., Paper 2, pp. 62-66; '904 Pet. Reply, Paper 22, pp. 23-24; '904 POR, Paper 19, pp. 65-66.

Vercauteren and Forssén Disclose a "processor adapted to … evaluat[e] a quality of each of the plurality of signals transmitted from the plurality of fixed radio ports"

Vercauteren

It is clear that when such relay links MTGCRN are used, some relay link measurements have to be used for the hand-over decision because the roaming relay station RRS behaves towards the fixed level FL as a mobile terminal itself. If this is the case, the overall communication path over

Vercauteren, EX1007, 16:65-17:2.

VWGoA's Expert, Dr. Ding

4:6-8. Accordingly, a POSITA would have been motivated to have a processor at the roaming relay station in order to select an optimal communication path at a roaming relay station. Vercauteren's disclosure that "a tracking step in which both the radio link and relay link measurement data are gathered in the mobile terminal, the signalling [*sic*] load associated to the hand-over protocol is clearly removed from the fixed network." Vercauteren, 4:66-5:2. Thus, removing the load from the fixed network would be an added motivation to have a roaming relay station selecting an optimal communication path, i.e., selecting a communication maximizing an amount of transferred information to a mobile terminal. Further,

'904 First Ding Decl., EX1003, ¶252.

Indeed, I understand that Mr. Lanning conceded "you can go get the same functionality or the same circuits that are provided in [a] standard base station that is well known" for use in a moving base station. EX1035, 206:3-8. Thus, for the reasons discussed in my original declaration, the combination of Vercauteren and Forssén teach this element.

'904 Ding Reply Decl., EX1030, ¶63.

'904 First Pet., Paper 2, pp. 69-72; '904 Pet. Reply, Paper 22, pp. 24-25; '904 POR, Paper 19, pp. 69-73.

The Combination of Vercauteren and Forssén Discloses the Elements of Independent Claims 22, 34, and 50

’904 Patent – Claim 22	
22. An apparatus adapted to move in accordance with a movement of a mobile unit moving relative to a plurality of fixed radio ports, the apparatus comprising:	’904 First Pet., p. 61-63.
a receiver adapted to receive a plurality of signals, each of the plurality of signals transmitted from each of the plurality of fixed radio ports within a frequency band having a lower limit greater than 300 megahertz;	’904 First Pet., p. 63-66.
a transmitter adapted to transmit, within the frequency band, a resultant signal to the mobile unit in accordance with at least one of the plurality of signals; and	’904 First Pet., p. 66-69.
a processor adapted to maximize an amount of transferred information to the mobile unit by evaluating a quality of each of the plurality of signals transmitted from the plurality of fixed radio ports.	’904 First Pet., p. 69-72.

’904 First Pet., Paper 2, pp. 61-72.

Gilhousen865 discloses its airborne base station "simultaneously handing off the plurality of mobile units to a second fixed port of the plurality fixed ports"

Carucel's Argument

> Critically, *Gilhousen865* does not contain any disclosure, teaching or suggestion that **a moveable base station** simultaneously hands off the plurality of mobile units. *See* Ex. 1005 at 3:52-54. Instead, as evidenced by Petitioner's own assertion, *Gilhousen865* explicitly discloses that its "hand off" function is performed by its **radiotelephone**. *See* 1573-Petition at 36 (citing Ex.1005 at 3:52-59).

'904 POR, pp. 89-90.

Gilhousen865

borne base station is illustrated in FIG. 4. Once the radiotelephone is registered with the aircraft base station, the aircraft base station then searches for the strongest pilot signal from a ground base station and registers with that base station.

Gilhousen865, 4:1-5.

the radiotelephone registering with the airborne base station;

the ail;borne base station detecting the pilot signals from the plurality of ground base stations;

the airborne base station registering the radiotelephone with a first ground base station of the plurality of base stations in response to a quality indication of the first ground base station's pilot signal;

the airborne base station relaying signals between the radiotelephone and the first ground base station;

if the quality indication of the pilot signal is less than a predetermined threshold, the airborne base station detecting the pilot signals from the plurality of ground base stations; and

if the quality indication of the pilot signal is less than a predetermined threshold, the airborne base station registering the radiotelephone with a second ground base station of the plurality of base stations in response to the quality indication of the second ground base station's pilot signal.

Gilhousen865, Claim 7.

'904 Second Pet., pp. 35-37; '904 Pet. Reply, pp. 19-20.

Gilhousen865 discloses its airborne base station "simultaneously handing off the plurality of mobile units to a second fixed port of the plurality fixed ports"

Gilhousen865 discloses a hand-off, contrary to Patent Owner's assertions

Petitioner's Expert, Dr. Ding

44. First, Mr. Lanning's contention that Gilhousen865 does not disclose any type of handoff is contrary to the plain disclosure of Gilhousen865. The entire point of Gilhousen865 is to enable "the call from the airborne radiotelephone [to be] handed off to the next cell as it reaches the edge of the cell's coverage." EX1005, 1:44-48. And Gilhousen865 explicitly discloses that its system provides this capability. *Id.*, 3:51-52. Such techniques were also well known in the art, as I explained in my original declaration. EX1029, ¶¶53-62. Second, Gilhousen865

'904 Ding Reply Decl., ¶44.

'904 Second Pet., pp. 35-37; '904 Pet. Reply, pp. 19-20.

Gilhousen865 Discloses the Elements of Independent Claim 56

’904 Patent – Claim 56	
56. A method of providing a communication connection between a communication network and a plurality of mobile units having a motion relative to a plurality of fixed ports, wherein the plurality of fixed ports are communicatively coupled to the communication network, the method comprising the steps of:	’904 Second Pet., p. 26-32.
establishing a first communication link between the plurality of mobile units and a first fixed port of the plurality of fixed ports through a movable base station having a motion in accordance with the motion of the mobile units; and	’904 Second Pet., p. 33-35.
simultaneously handing off the plurality of mobile units to a second fixed port of the plurality fixed ports.	’904 Second Pet., p. 35-37.

’904 Second Pet., pp. 26-37.

Vercauteren discloses its roaming relay station "simultaneously handing off the plurality of mobile units to a second fixed port of the plurality fixed ports"

Patent Owner does not dispute that Vercauteren discloses this element; rather, PO merely disputes whether this function is performed by Vercauteren's roaming relay station.

'904 Pet. Reply, p. 28.

VWGoA's Expert, Dr. Ding

173. However, in the case of a roaming relay station (RRS) mounted on a train, Vercauteren discloses "the roaming relay station RRS behaves towards the fixed level FL **as a mobile terminal itself**." *Id.*, 16:65-17:2, emphasis added. A POSITA would therefore have understood that because the RRS is moving similarly to a mobile terminal, it would be advantageous to implement collection and organization of measurement data in the RRS, for example, tracking and measuring signals transmitted by various fixed base stations. For example, Vercauteren discloses that "by providing a tracking step in which both the radio link and relay link measurement data are gathered in the mobile terminal, the signalling [*sic*] load associated to the hand-over protocol is clearly removed from the fixed network." *Id.*, 4:66-5:2. Thus, a POSITA would have recognized that advantages of removing the load from the fixed network would provide a motivation to have an RRS selecting an optimal communication path, i.e., selecting a communication maximizing an amount of transferred information to a mobile terminal. Further, because a communication link between an RRS and the fixed base station would change more rapidly compared to a communication link between an RRS and a mobile terminal, performing the signal evaluation logic at the RRS would generate overall less load on the network.

'904 Second Ding Decl., ¶173.

'904 Second Pet., pp. 60-62; '904 Pet. Reply, p. 28; '904 POR, pp. 92-93.

Petitioner's Demonstrative Exhibit
Not Evidence

Vercauteren Discloses the Elements of Independent Claim 56

’904 Patent – Claim 56	
56. A method of providing a communication connection between a communication network and a plurality of mobile units having a motion relative to a plurality of fixed ports, wherein the plurality of fixed ports are communicatively coupled to the communication network, the method comprising the steps of:	’904 Second Pet., p. 52-57.
establishing a first communication link between the plurality of mobile units and a first fixed port of the plurality of fixed ports through a movable base station having a motion in accordance with the motion of the mobile units; and	’904 Second Pet., p. 58-60.
simultaneously handing off the plurality of mobile units to a second fixed port of the plurality fixed ports.	’904 Second Pet., p. 60-62.

’904 Second Pet., pp. 52-62.

Gilhousen865 and Gilhousen390 disclose "wherein the processor is further adapted to determine a best fixed radio port" (Claim 28)

Carucel's Argument

In stark contrast, the '904 Patent provides that "determin[ing] a best fixed radio port" is more than just analyzing the strongest signal: "[t]he procedures for determining whether a mobile unit is to be served by a fixed base station or a moving base station are the same procedures as described earlier herein in determining which moving base station is selected to serve a mobile unit, i.e., based on signal strength and error rate." Ex. 1001 at 11:7-12. At a minimum, "determin[ing] a best fixed radio port" includes an analysis of the signal quality (i.e., error rate) in addition to the signal strength when viewed in the entire context of the '904 Patent. *See* Lanning Decl. ¶192.

'904 POR, p. 52.

Carucel did not propose a construction for the term "best fixed radio port," and the claim itself defines the term.

'904 Pet. Reply, p. 15.

28. An apparatus in accordance with claim **22**, wherein the processor is further adapted to determine a best fixed radio port of the plurality of fixed radio ports, the best fixed radio port enabling the maximization of the amount of transferred information to the mobile unit.

'904 patent, Claim 28.

Carucel did not challenge the prior art's disclosure of "maximiz[ing] an amount of transferred information" in claim 22.

'904 First Pet., p. 46; '904 Pet. Reply, pp.15-17; '904 POR, p. 52.

Gilhousen865 and Gilhousen390 disclose "wherein the processor is further adapted to determine a best fixed radio port" (Claim 28)

Even considering Carucel's narrow construction, Gilhousen865 and Gilhousen390 teach this element.

Petitioner's Expert, Dr. Ding

38. For example, Gilhousen390 discloses "maximal ratio combining" in which "[t]he **signal-to-noise ratio** is determined for both paths being combined with the contributions from the two paths weighted accordingly. Combining is coherent since pilot signal demodulation allows the phase of each path to be determined." EX1006, 8:24-30. A POSA would have understood that there is a 1-to-1 mapping between signal-to-noise ratio and error rate for a given modulation and coding. In other words, each value of error rate corresponds to a specific signal-to-noise ratio, and vice versa. *See, e.g.*, EX1041, Pyndiah, 1042 (Figures 4-6 illustrating the one-to-one correspondence between bit error rate (BER) and signal-to-noise ratio (SNR)). For example, U.S. Patent No. 6,292,651 to Dapper explains that "the signal to noise ratio estimate is directly related to a probable bit error rate, such probable bit error rate can be utilized for channel monitoring in order to determine whether a bad or good channel exists." EX1042, Dapper, 77:40-44. Thus, as part of the diversity techniques employed at Gilhousen865's airborne base station, a POSA would have found it obvious to consider the signal-to-noise ratio in determining the "best fixed radio port" and weighting the received signal accordingly. *Id.*

'904 Ding Reply Decl., ¶38.

'904 Pet. Reply, p. 17.

Petitioner's Demonstrative Exhibit
Not Evidence

Motivation to Combine Vercauteren and Forssén

VWGoA's Expert, Dr. Ding

219. Vercauteren, as discussed above, discloses a communication network connecting mobile terminal to a number of fixed base stations via a relay station, which can be mounted on a moving vehicle such as a train. Vercauteren, 2:32-41. And, while Vercauteren also discloses that the relay station is connected to a "global coverage radio network (GCRN)" *Id.*, 8:54-58 and an "indirect coverage mobile radio network ICMRN" *Id.*, 8:36-41, Vercauteren does not explicitly disclose the details of how the relay station is configured to receive and transmit signals between the mobile terminals and the fixed base station. In other words, information about the architecture of the relay station is not disclosed in Vercauteren. Accordingly, a POSITA would therefore have been motivated to look the references that provide such details, such as an architecture or system information of a relay station or a base station to use in the mobile communication networks. A POSITA looking for such a reference would find Forssén useful.

'904 First Ding Decl., ¶219.

226. Accordingly, a POSITA would have been motivated to combine Forssén's teaching of transceiver in a base station to Vercauteren's mobile relay station on a train. Forssén's base station architecture with antenna array 12, spatial filter 14, and power allocation means 54 would allow Vercauteren's roaming relay station to receive signals from various fixed based stations and to transmit signals to mobile terminals on a train, as well as to communicate in the reverse direction. And, implementing Forssén's transceiver, antenna array, etc., in the Vercauteren's mobile relay station would have been nothing more than combining known elements to yield predictable results, with reasonable expectation of success based on the well-known operations of receiving and transmitting data within a cellular communication network. While Forssén's array of antennas are spatially separated and are capable of receiving "a vast number of radio signals," a POSITA using the spatially separated antenna as taught by Forssén in Vercauteren's mobile relay station could provide communication between the mobile terminals and fixed base stations where the mobile relay stations act as intermediaries.

'904 First Ding Decl., ¶226.

'904 First Pet., pp. 59-61.

Petitioner's Demonstrative Exhibit
Not Evidence

Motivation to Combine Vercauteren and Gilhousen390

VWGoA's Expert, Dr. Ding

180. As such, for similar reasons as those discussed in Section VII.A, a POSITA would have been motivated to modify Vercauteren's system with any one or more of the signal diversity configurations of Gilhousen390 at least for the purpose of reducing errors caused by well-known deleterious effects on wirelessly-transmitted signals. More specifically, a POSITA would have been motivated to incorporate Gilhousen390's data receivers, which are individually configurable to extract multiple signals received from the same or different base stations, and control processor functions into Vercauteren's roaming relay station to tune to received signals with the best signal qualities from among those received. EX1006, 13:10-20. To a POSITA, this would have been nothing more than incorporating well-known techniques (i.e., Gilhousen390's diversity techniques) into a well-known system (i.e., Vercauteren's communication system with train-mounted relay station). And a POSITA would have had a reasonable expectation of success in

'904 Second Ding Decl., ¶180.

'904 Second Pet., pp. 63-64; '904 First Ding Decl., ¶226.

Motivation to Combine Vercauteren, Gilhousen390, and Forssén

VWGoA's Expert, Dr. Ding

203. Consistent with this disclosure, a POSITA would have been motivated to implement components similar to Forssén's antenna array 12 and spatial filter 14 as part of the relay station of Vercauteren mounted on a train. These components would allow Vercauteren's roaming relay station to receive signals from various fixed based stations and transmit signals to mobile terminals on the train, as well as communicate in the reverse direction. Forssén's techniques employing these components would further enable "extract[ion] of individual signals … even if they occupy the same frequency band," addressing cellular system capacity issues. And these components are also especially useful during a hand-off, for example, as the spatial filters can be used to "enhance a desired spatial channel while suppressing other spatial channels," depending on the strength of received signals. EX1008, 2:40-44.

'904 Second Ding Decl., ¶203.

204. Implementing such components in Vercauteren's relay station would have been nothing more than combining known elements to yield predictable results. For example, the proposed combination of Vercauteren, Forssén, and Gilhousen390 would involve nothing more than incorporating well-known concepts (i.e., antenna arrays and spatial filtering) into a well-known system (i.e., Vercauteren's network of communication between mobile devices and base stations via a relay), which would allow communication quality to be maintained at a high level as Vercauteren's train moves. And a POSITA would have had a reasonable expectation of success based on the well-known operations of receiving and transmitting data within a cellular communication network, as I discuss in Section IV.A, which would be performed by Vercauteren's relay station.

'904 Second Ding Decl., ¶204.

'904 Second Pet., pp. 72-75.

Questions?